US010073542B2

(12) **United States Patent**
Kato

(10) **Patent No.: US 10,073,542 B2**
(45) **Date of Patent: Sep. 11, 2018**

(54) **INFORMATION PROCESSING APPARATUS AND TRANSMISSION SYSTEM FOR REDUCING SCREEN FAILURE WHEN DISPLAY DATA IS TRANSMITTED TO A DESTINATION**

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(73) Assignee: **Ricoh Company, Ltd.**, Tokyo (JP)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 133 days.

(21) Appl. No.: **15/159,096**

(22) Filed: **May 19, 2016**

(65) **Prior Publication Data**

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Related U.S. Application Data

(63) Continuation of application No. PCT/JP2014/083914, filed on Dec. 22, 2014.

(30) **Foreign Application Priority Data**

Dec. 25, 2013 (JP) 2013-267983

(51) **Int. Cl.**
G06F 3/0354 (2013.01)
G06F 13/00 (2006.01)
(Continued)

(52) **U.S. Cl.**
CPC ***G06F 3/03543*** (2013.01); ***G06F 3/1415*** (2013.01); ***G06F 3/1438*** (2013.01);
(Continued)

(58) **Field of Classification Search**
None
See application file for complete search history.

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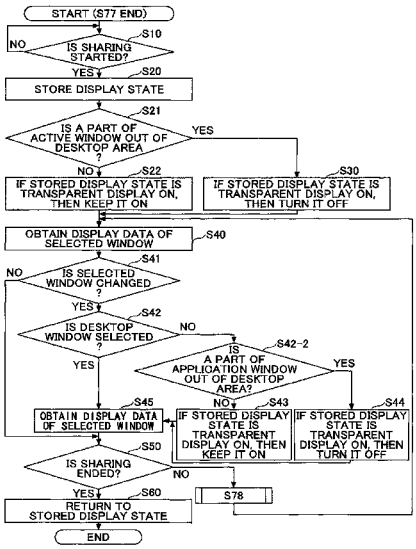
Primary Examiner — Chad Dicke
(74) *Attorney, Agent, or Firm* — Oblon, McClelland, Maier & Neustadt, L.L.P.

(57) **ABSTRACT**

An information processing apparatus **10***aa* capable of communicating with another apparatus via a network **2** is provided. The information processing apparatus **10***aa* includes a display unit **14***b* configured to display an image on a display apparatus included in or connected to the information processing apparatus; a transmission unit **11** configured to transmit image data of the image displayed on the display apparatus to the other apparatus; and a reducing unit **18** configured to reduce a process load involved in displaying the image on the display apparatus in the case where the transmission unit transmits the image data to the other apparatus.

12 Claims, 29 Drawing Sheets



(51) **Int. Cl.**

H04M 3/56	(2006.01)
G06F 3/14	(2006.01)
G06T 1/20	(2006.01)
H04N 7/14	(2006.01)
H04N 7/15	(2006.01)
G09G 5/14	(2006.01)

(52) **U.S. Cl.**

CPC ***G06F 3/1454*** (2013.01); ***G06F 13/00*** (2013.01); ***G06T 1/20*** (2013.01); ***H04M 3/56*** (2013.01); ***H04N 7/147*** (2013.01); ***H04N 7/15*** (2013.01); *G09G 5/14* (2013.01); *G09G 2310/04* (2013.01); *G09G 2350/00* (2013.01); *G09G 2370/025* (2013.01); *H04N 7/152* (2013.01)

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* cited by examiner

FIG.1

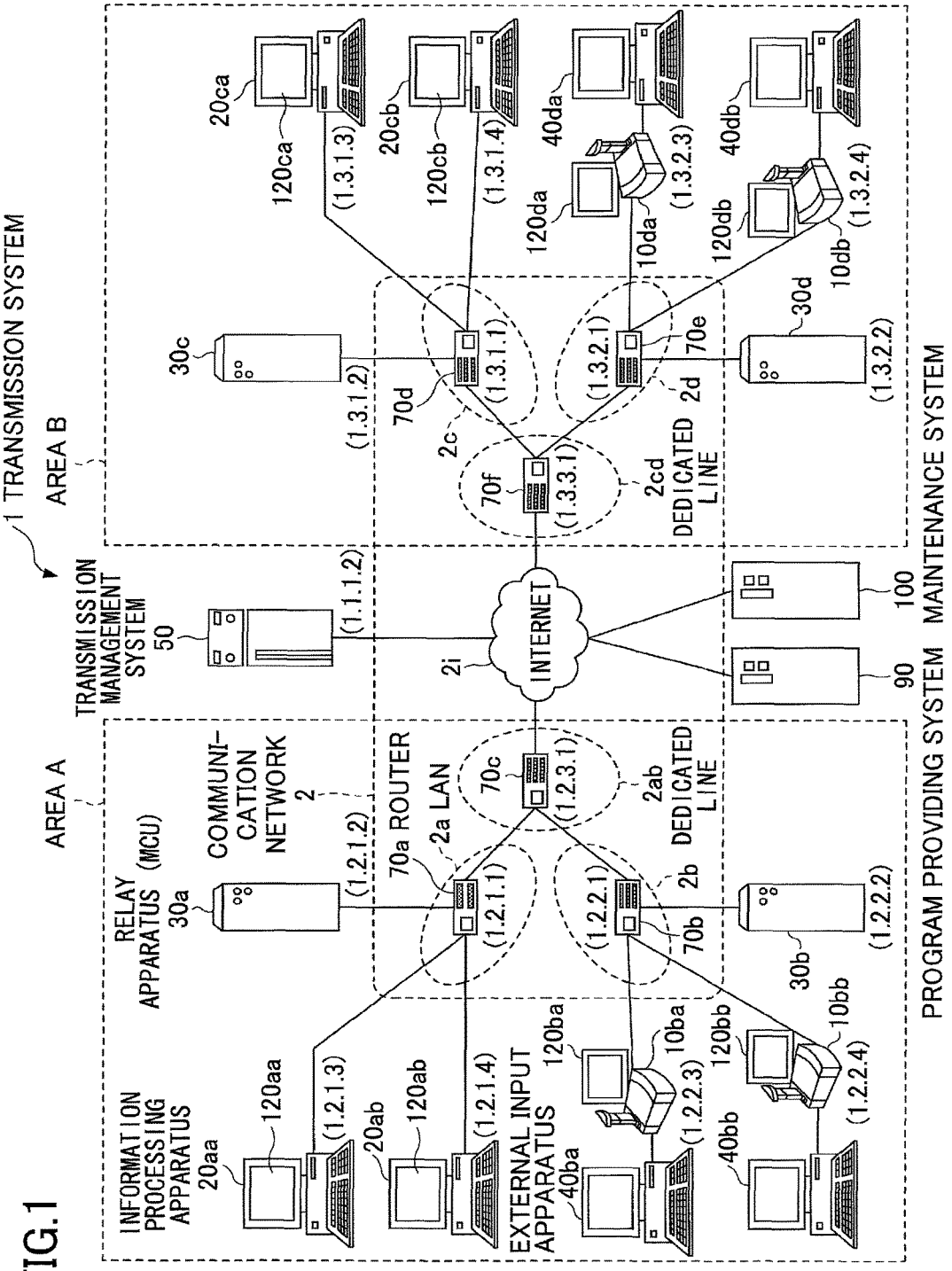

1 TRANSMISSION SYSTEM
AREA A
AREA B
TRANSMISSION MANAGEMENT SYSTEM 50
(1.1.1.2)
2i
INTERNET
100
90
MAINTENANCE SYSTEM
PROGRAM PROVIDING SYSTEM
COMMUNICATION NETWORK 2
(1.2.1.2)
70a ROUTER
2a LAN
70c
(1.2.3.1)
2ab DEDICATED LINE
2b
RELAY APPARATUS (MCU) 30a
(1.2.1.1)
(1.2.2.1)
70b
30b
(1.2.2.2)
INFORMATION PROCESSING APPARATUS 20aa
120aa
(1.2.1.3)
20ab
120ab
(1.2.1.4)
EXTERNAL INPUT APPARATUS 40ba
120ba
10ba
(1.2.2.3)
120bb
10bb
(1.2.2.4)
40bb
30c
(1.3.1.2)
70d
(1.3.1.1)
2c
70f
(1.3.3.1)
2cd DEDICATED LINE
(1.3.2.1)
70e
2d
30d
(1.3.2.2)
20ca
120ca
(1.3.1.3)
20cb
120cb
(1.3.1.4)
40da
120da
10da
(1.3.2.3)
40db
120db
10db
(1.3.2.4)

FIG.2

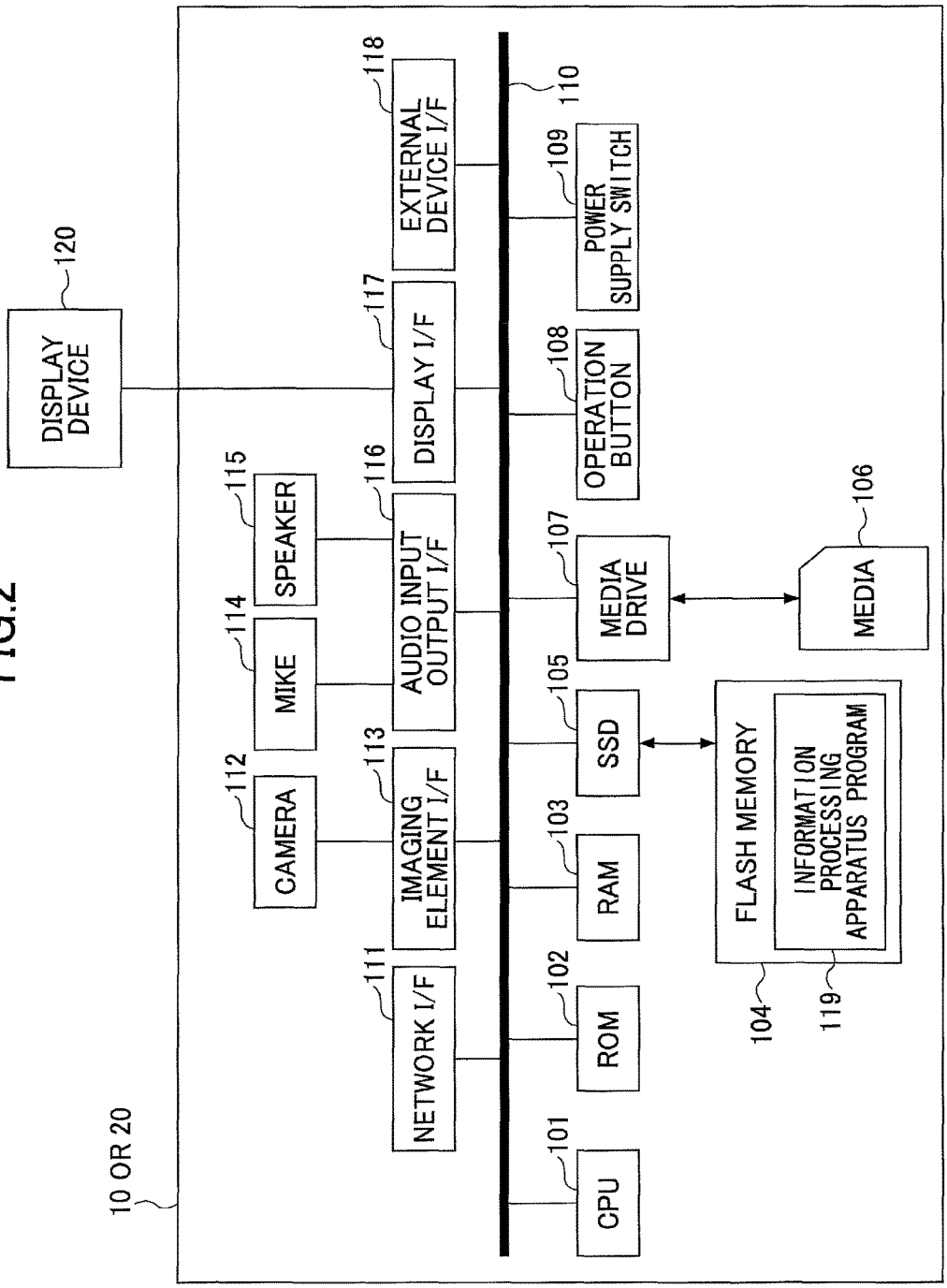
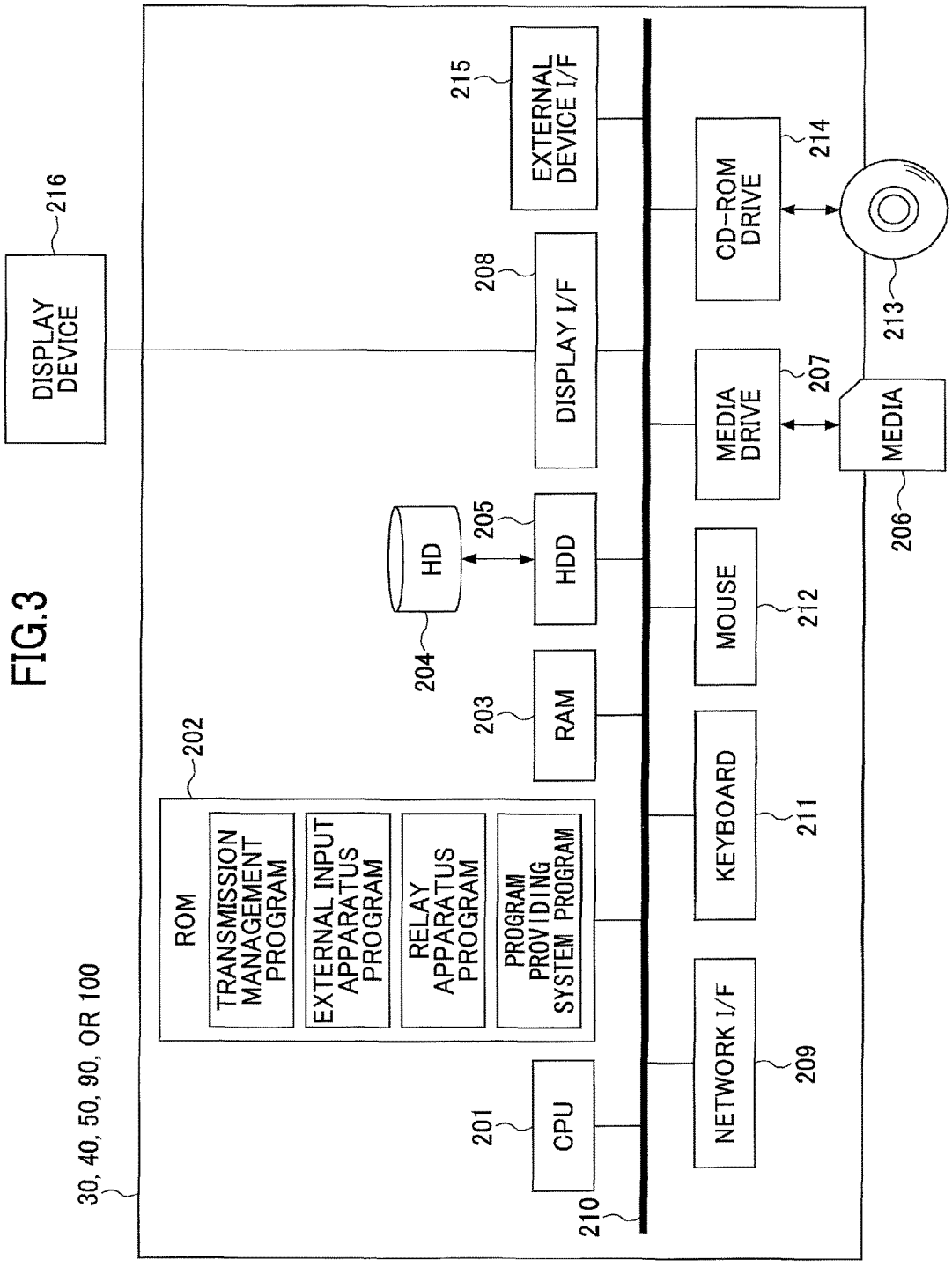

10 OR 20
DISPLAY DEVICE
120
CPU
101
ROM
102
RAM
103
SSD
105
FLASH MEMORY
104
INFORMATION PROCESSING APPARATUS PROGRAM
119
MEDIA DRIVE
107
MEDIA
106
OPERATION BUTTON
108
POWER SUPPLY SWITCH
109
110
EXTERNAL DEVICE I/F
118
DISPLAY I/F
117
AUDIO INPUT OUTPUT I/F
116
SPEAKER
115
MIKE
114
CAMERA
112
IMAGING ELEMENT I/F
113
NETWORK I/F
111

FIG.3


30, 40, 50, 90, OR 100
DISPLAY DEVICE
216
EXTERNAL DEVICE I/F
215
DISPLAY I/F
208
CD-ROM DRIVE
214
MEDIA DRIVE
207
MEDIA
213
206
HD
204
HDD
205
RAM
203
MOUSE
212
KEYBOARD
211
NETWORK I/F
209
CPU
201
210
ROM
202
TRANSMISSION MANAGEMENT PROGRAM
EXTERNAL INPUT APPARATUS PROGRAM
RELAY APPARATUS PROGRAM
PROGRAM PROVIDING SYSTEM PROGRAM

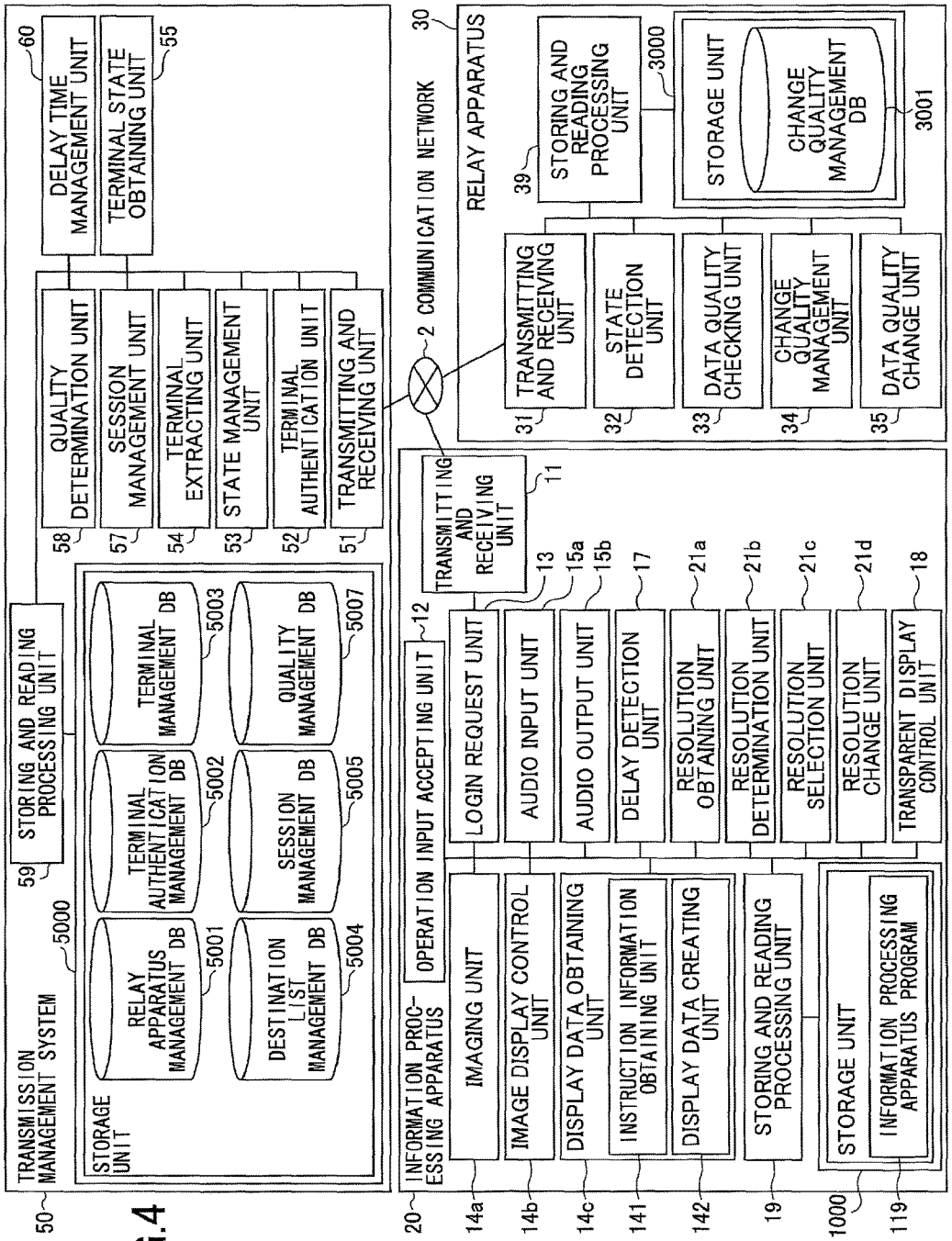

TRANSMISSION MANAGEMENT SYSTEM
50
STORAGE UNIT
5000
RELAY APPARATUS MANAGEMENT DB
5001
TERMINAL AUTHENTICATION MANAGEMENT DB
5002
TERMINAL MANAGEMENT DB
5003
DESTINATION LIST MANAGEMENT DB
5004
SESSION MANAGEMENT DB
5005
QUALITY MANAGEMENT DB
5007
59 STORING AND READING PROCESSING UNIT
58 QUALITY DETERMINATION UNIT
57 SESSION MANAGEMENT UNIT
54 TERMINAL EXTRACTING UNIT
53 STATE MANAGEMENT UNIT
52 TERMINAL AUTHENTICATION UNIT
51 TRANSMITTING AND RECEIVING UNIT
60 DELAY TIME MANAGEMENT UNIT
55 TERMINAL STATE OBTAINING UNIT
2 COMMUNICATION NETWORK
RELAY APPARATUS
30
31 TRANSMITTING AND RECEIVING UNIT
32 STATE DETECTION UNIT
33 DATA QUALITY CHECKING UNIT
34 CHANGE QUALITY MANAGEMENT UNIT
35 DATA QUALITY CHANGE UNIT
39 STORING AND READING PROCESSING UNIT
3000
STORAGE UNIT
CHANGE QUALITY MANAGEMENT DB
3001
INFORMATION PROCESSING APPARATUS
20
OPERATION INPUT ACCEPTING UNIT
12
TRANSMITTING AND RECEIVING UNIT
11
IMAGING UNIT
14a
IMAGE DISPLAY CONTROL UNIT
14b
DISPLAY DATA OBTAINING UNIT
14c
INSTRUCTION INFORMATION OBTAINING UNIT
141
DISPLAY DATA CREATING UNIT
142
STORING AND READING PROCESSING UNIT
19
STORAGE UNIT
1000
INFORMATION PROCESSING APPARATUS PROGRAM
119
LOGIN REQUEST UNIT
13
AUDIO INPUT UNIT
15a
AUDIO OUTPUT UNIT
15b
DELAY DETECTION UNIT
17
RESOLUTION OBTAINING UNIT
21a
RESOLUTION DETERMINATION UNIT
21b
RESOLUTION SELECTION UNIT
21c
RESOLUTION CHANGE UNIT
21d
TRANSPARENT DISPLAY CONTROL UNIT
18

FIG.4

FIG.5A

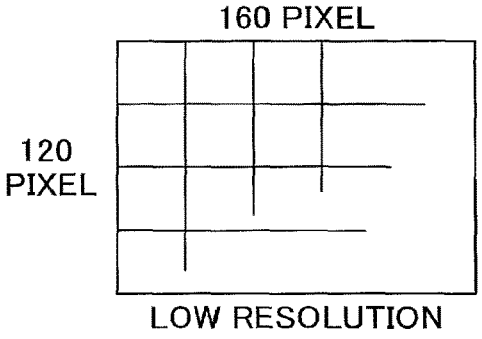


FIG.5B

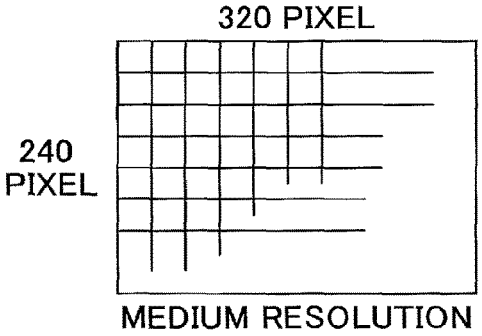


FIG.5C

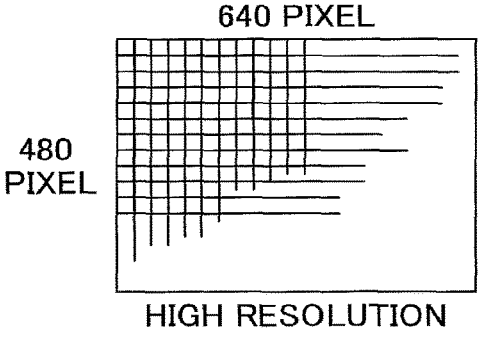


FIG.6

301t CHANGE QUALITY MANAGEMENT TABLE

IP ADDRESS OF RELAY DESTINATION TERMINAL	IMAGE QUALITY OF RELAYED IMAGE DATA (QUALITY OF IMAGE)
1.3.2.4	HIGH IMAGE QUALITY
1.3.1.3	LOW IMAGE QUALITY
1.3.4.3	MEDIUM IMAGE QUALITY
...	...

FIG.7

501t RELAY APPARATUS MANAGEMENT TABLE

RELAY APPARATUS ID	OPERATIONAL STATE	RECEIVE DATE AND TIME	IP ADDRESS OF RELAY APPARATUS	MAXIMUM DATA TRANSMISSION RATE (Mbps)
111a	ONLINE	2009.11.10.13:00	1.2.1.2	100
111b	ONLINE	2009.11.10.13:10	1.2.2.2	1000
111c	OFFLINE	2009.11.10.13:20	1.3.1.2	100
111d	ONLINE	2009.11.10.13:30	1.3.2.2	10

FIG.8

502t TERMINAL AUTHENTICATION MANAGEMENT TABLE

TERMINAL ID	PASSWORD
01aa	aaaa
01ab	abab
01ba	baba
...	...

FIG.9

503t TERMINAL MANAGEMENT TABLE

TERMINAL ID	OPERATIONAL STATE	RECEIVE DATE AND TIME	IP ADDRESS OF TERMINAL
01aa	ONLINE	2009.11.10.13:40	1.2.1.3
01ab	OFFLINE	2009.11.09.12:00	1.2.1.4
01ba	ONLINE	2009.11.10.13:45	1.2.2.3
...	...	...	...
01db	ONLINE	2009.11.10.13:50	1.3.2.4

FIG.10

504t DESTINATION LIST MANAGEMENT TABLE

REQUEST SOURCE TERMINAL ID	DESTINATION TERMINAL ID
01aa	01ab,01ba,01db
01ab	01aa,01ba,01ca
01ba	01aa,01ab,01cb,01da
...	...
01db	01aa,01ab,01da

FIG.11

505t SESSION MANAGEMENT TABLE

SELECTION SESSION ID	RELAY APPARATUS ID	REQUEST SOURCE TERMINAL ID	DESTI-NATION TERMINAL ID	DELAY TIME (ms)	RECEIVE DATE AND TIME WHEN DELAY INFORMATION IS RECEIVED
se1	111a	01aa	01db	200	2009.11.10.14:00
se2	111b	01ba	01ca	50	2009.11.10.14:10
se3	111d	01bb	01da	400	2009.11.10.14:20
...	...	...	...	...	...

FIG.12

507t QUALITY MANAGEMENT TABLE

DELAY TIME (ms)	IMAGE QUALITY OF IMAGE DATA (QUALITY OF IMAGE)
0～100	HIGH IMAGE QUALITY
100～300	MEDIUM IMAGE QUALITY
300～500	LOW IMAGE QUALITY
500～	(INTERRUPTION)

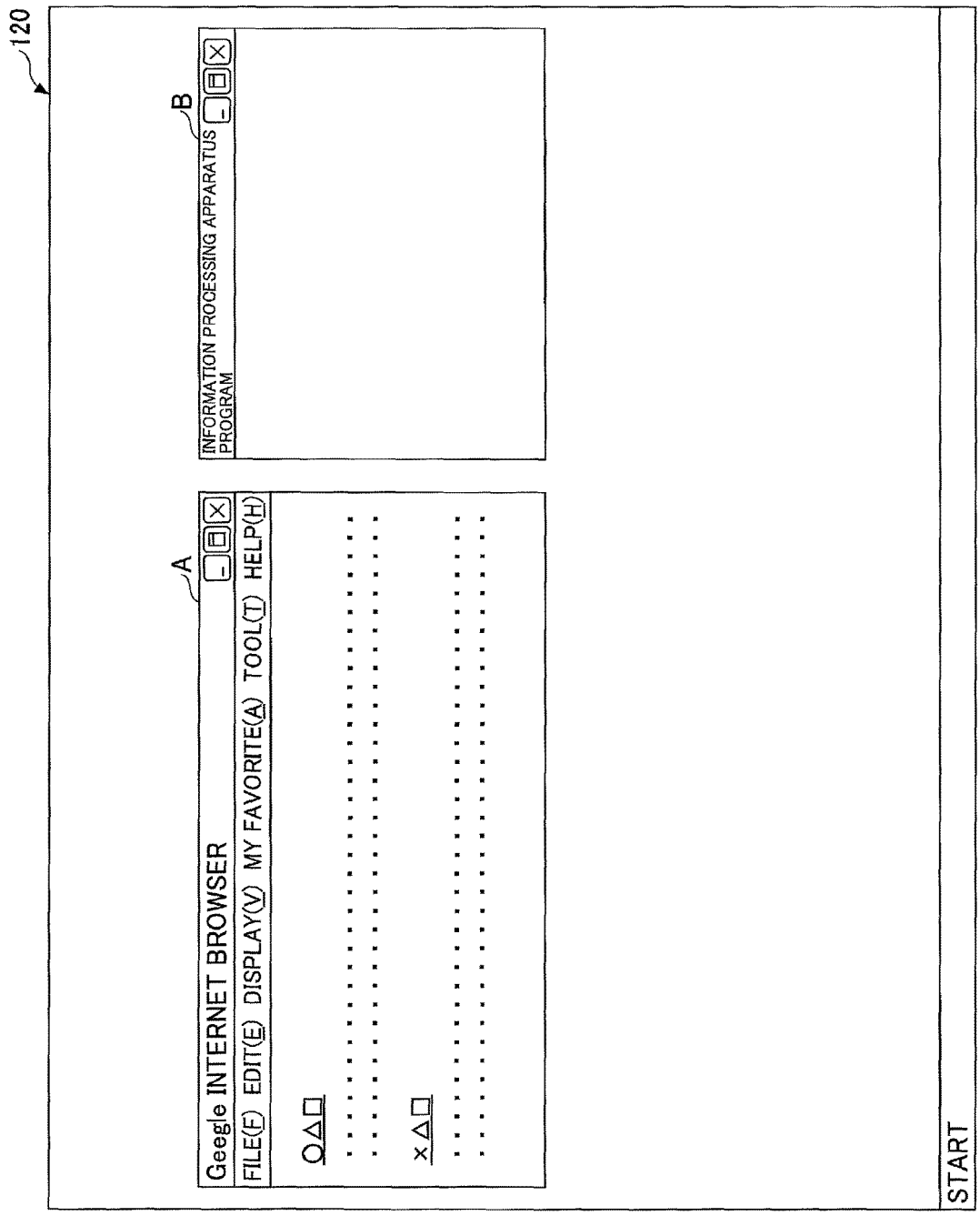
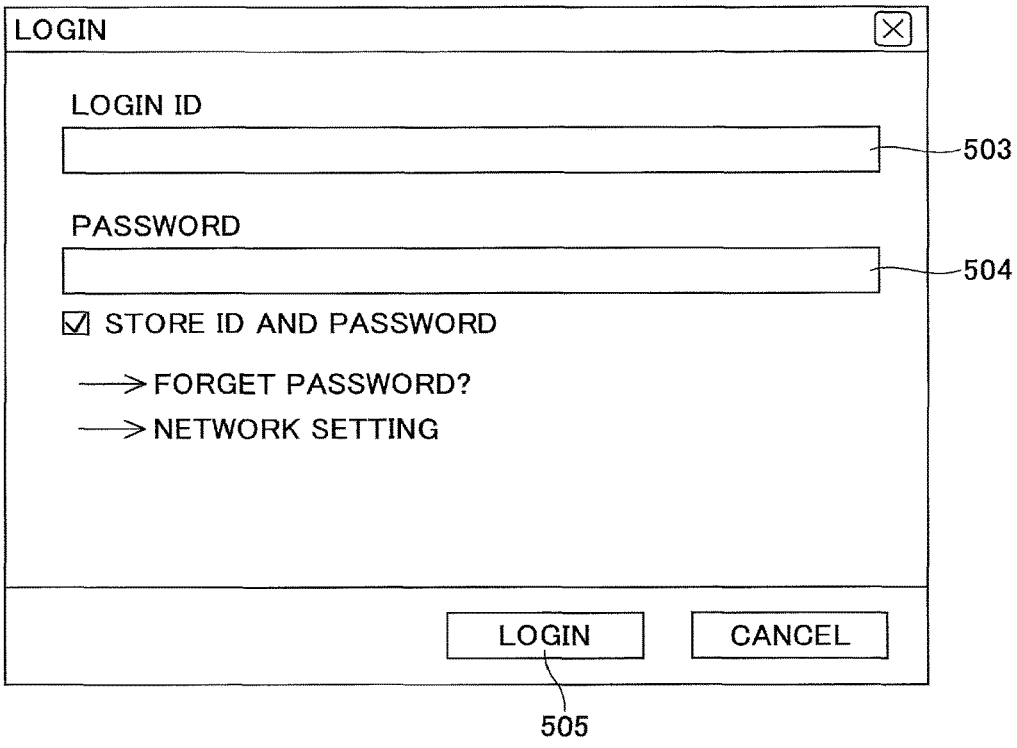

120
A
Geegle INTERNET BROWSER
FILE(F) EDIT(E) DISPLAY(V) MY FAVORITE(A) TOOL(T) HELP(H)
○△□
×△□
B
INFORMATION PROCESSING APPARATUS PROGRAM
START

FIG.13

FIG.14


LOGIN
LOGIN ID
503
PASSWORD
504
STORE ID AND PASSWORD
FORGET PASSWORD?
NETWORK SETTING
LOGIN
CANCEL
505

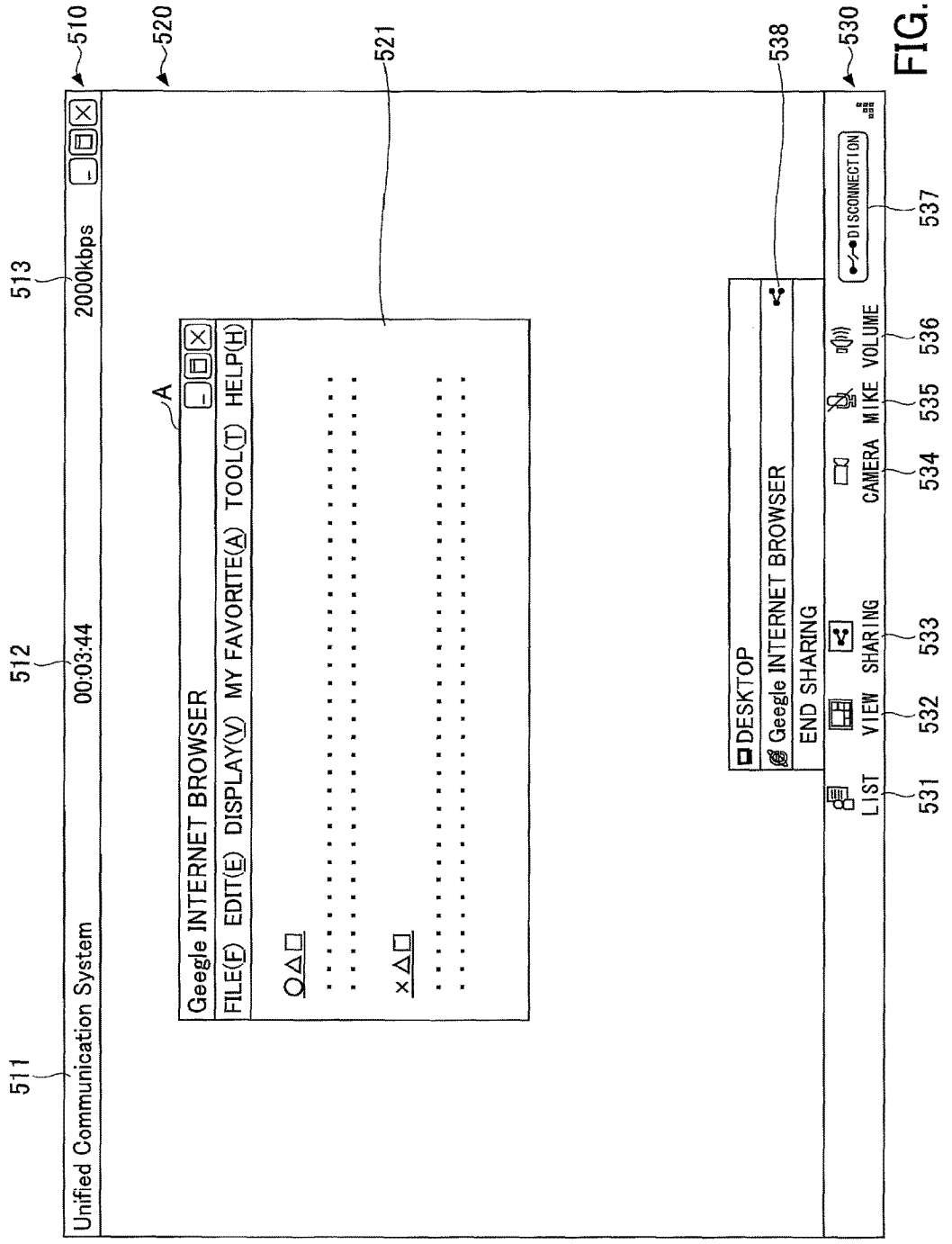

510
520
521
538
530
513
2000kbps
537
DISCONNECTION
A
Geegle INTERNET BROWSER
FILE(F) EDIT(E) DISPLAY(V) MY FAVORITE(A) TOOL(T) HELP(H)
VOLUME
536
MIKE
535
CAMERA
534
SHARING
533
VIEW
532
LIST
531
DESKTOP
Geegle INTERNET BROWSER
END SHARING
512
00:03:44
Unified Communication System
511

FIG.15

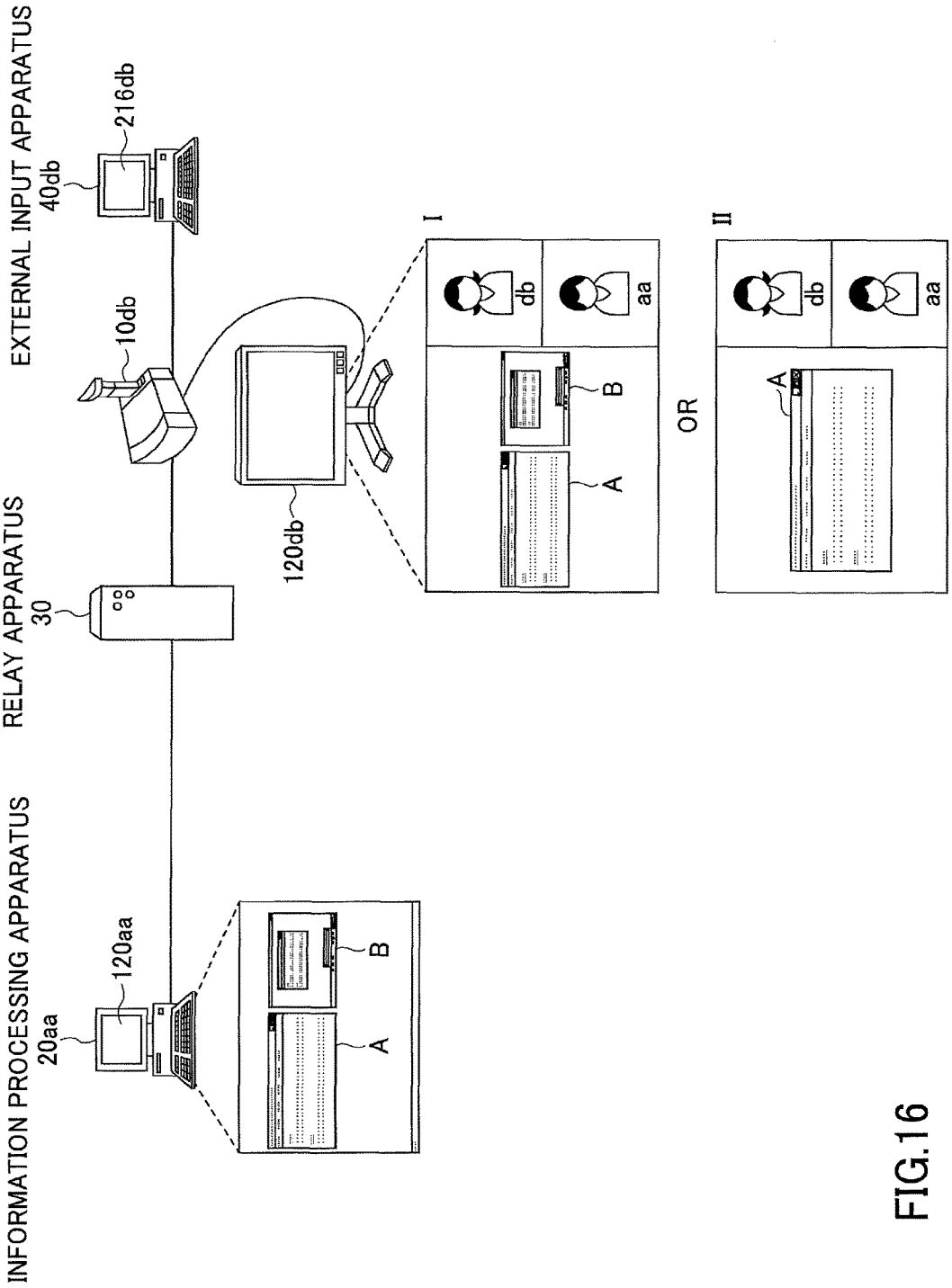

INFORMATION PROCESSING APPARATUS
20aa
120aa
A
B
RELAY APPARATUS
30
EXTERNAL INPUT APPARATUS
40db
216db
10db
120db
I
db
aa
B
A
OR
II
db
aa
A

FIG.16

FIG.17

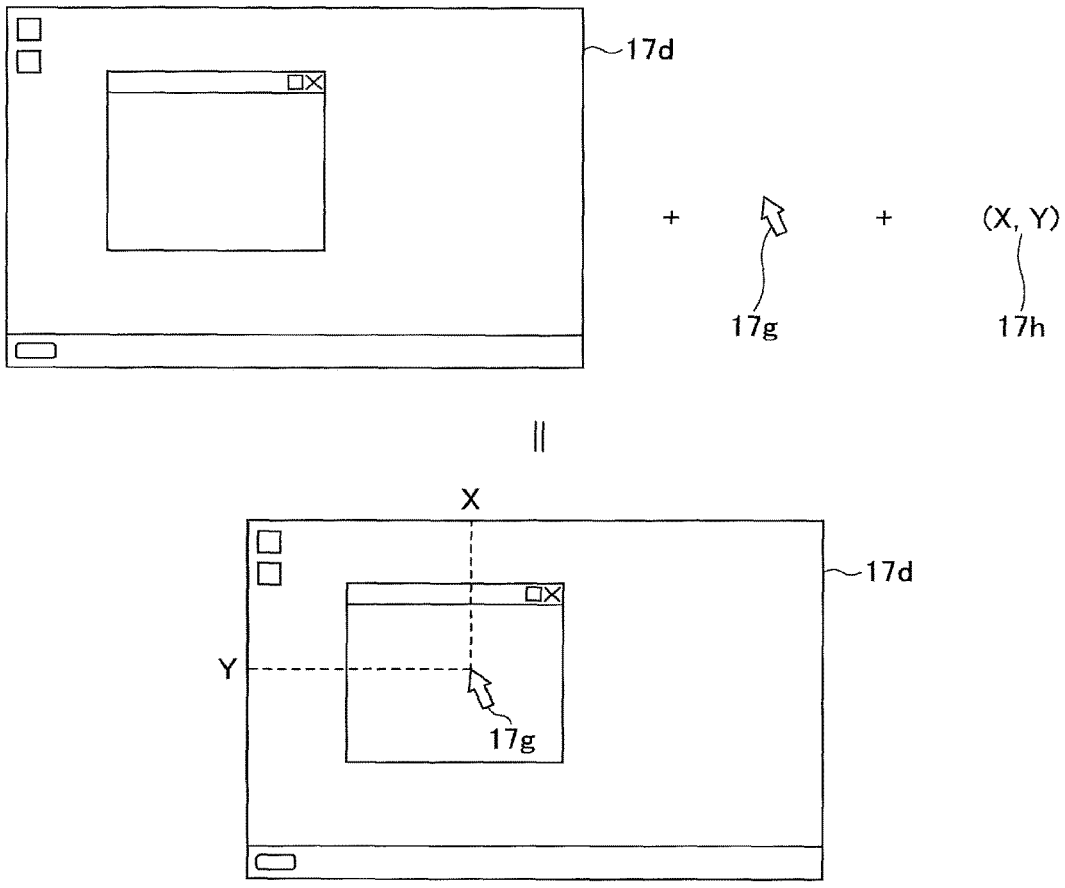


FIG.18

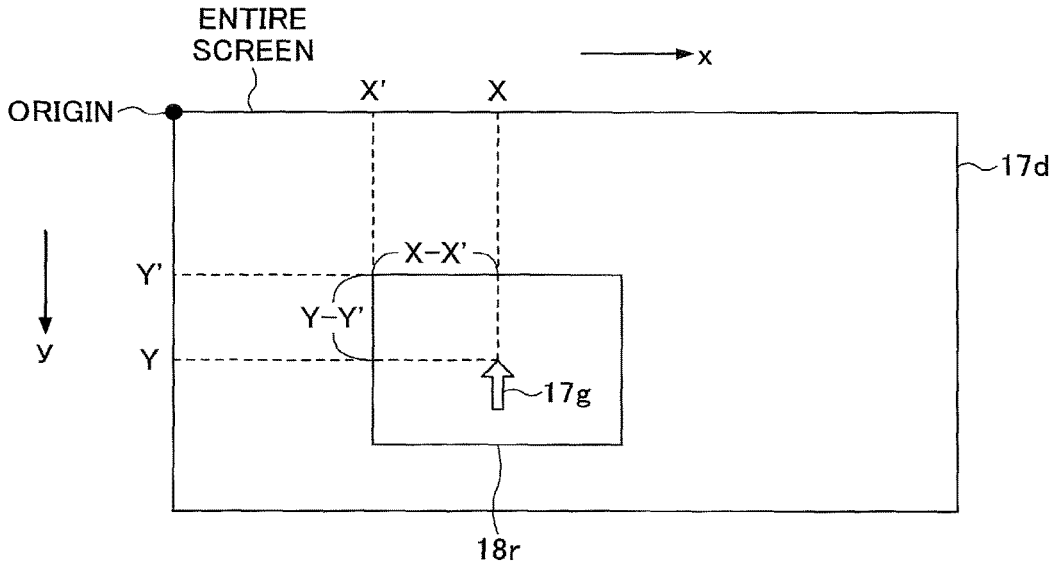


FIG.19

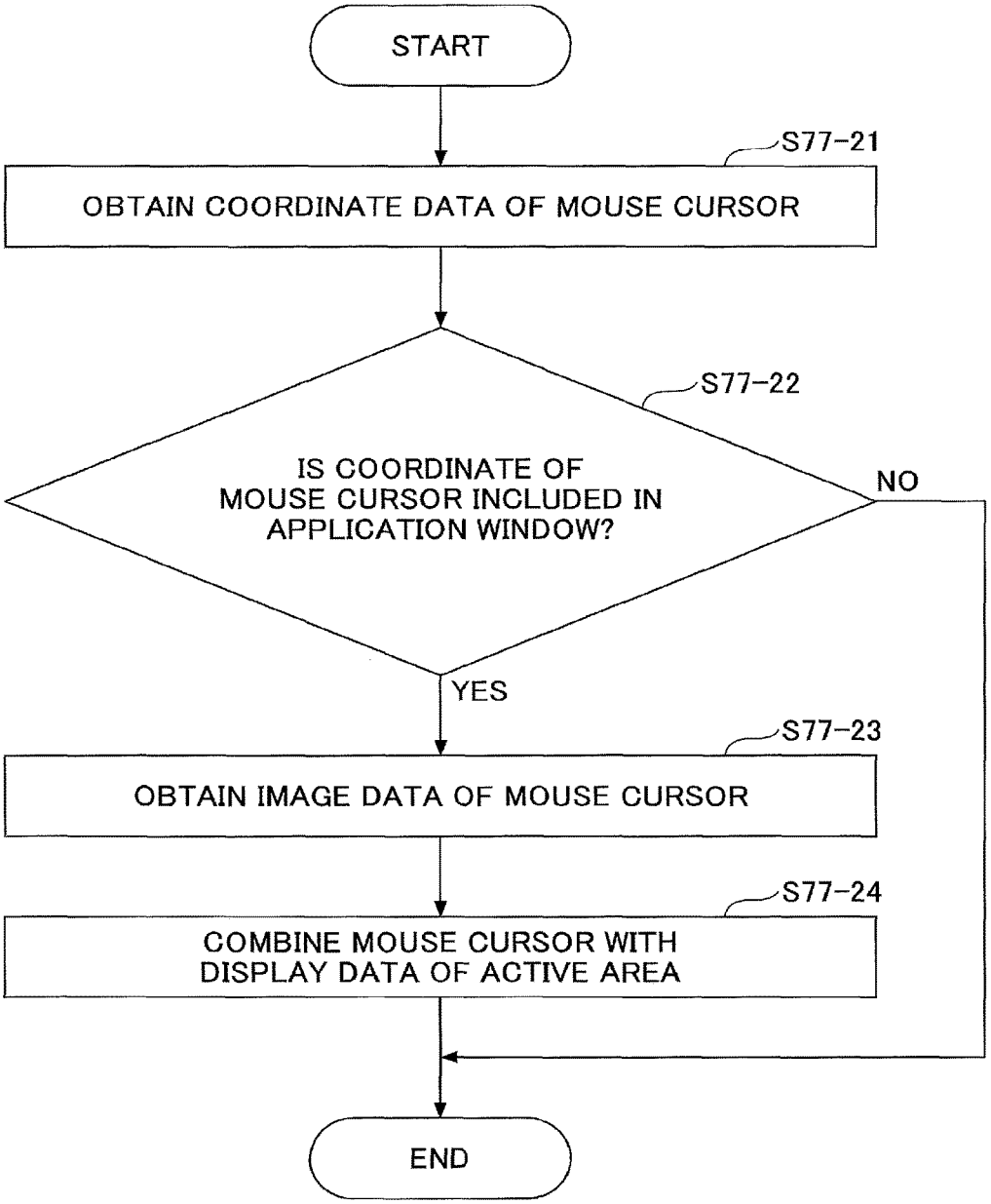
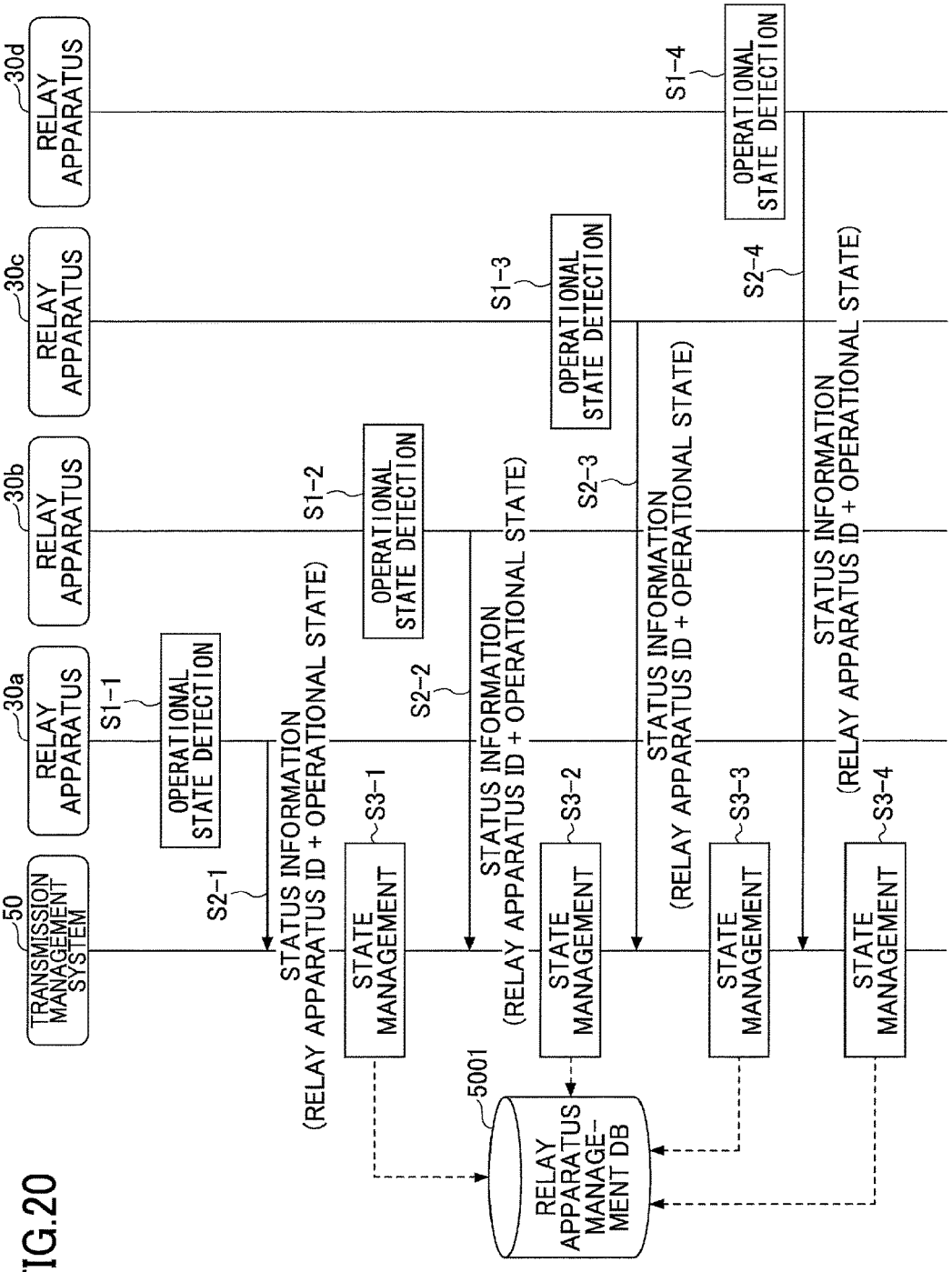

START
S77-21
OBTAIN COORDINATE DATA OF MOUSE CURSOR
S77-22
IS COORDINATE OF MOUSE CURSOR INCLUDED IN APPLICATION WINDOW?
NO
YES
S77-23
OBTAIN IMAGE DATA OF MOUSE CURSOR
S77-24
COMBINE MOUSE CURSOR WITH DISPLAY DATA OF ACTIVE AREA
END

FIG.20


50
TRANSMISSION MANAGEMENT SYSTEM
30a
RELAY APPARATUS
30b
RELAY APPARATUS
30c
RELAY APPARATUS
30d
RELAY APPARATUS
S1-1
OPERATIONAL STATE DETECTION
S1-2
OPERATIONAL STATE DETECTION
S1-3
OPERATIONAL STATE DETECTION
S1-4
OPERATIONAL STATE DETECTION
S2-1
STATUS INFORMATION (RELAY APPARATUS ID + OPERATIONAL STATE)
S2-2
STATUS INFORMATION (RELAY APPARATUS ID + OPERATIONAL STATE)
S2-3
STATUS INFORMATION (RELAY APPARATUS ID + OPERATIONAL STATE)
S2-4
STATUS INFORMATION (RELAY APPARATUS ID + OPERATIONAL STATE)
S3-1
STATE MANAGEMENT
S3-2
STATE MANAGEMENT
S3-3
STATE MANAGEMENT
S3-4
STATE MANAGEMENT
5001
RELAY APPARATUS MANAGE-MENT DB

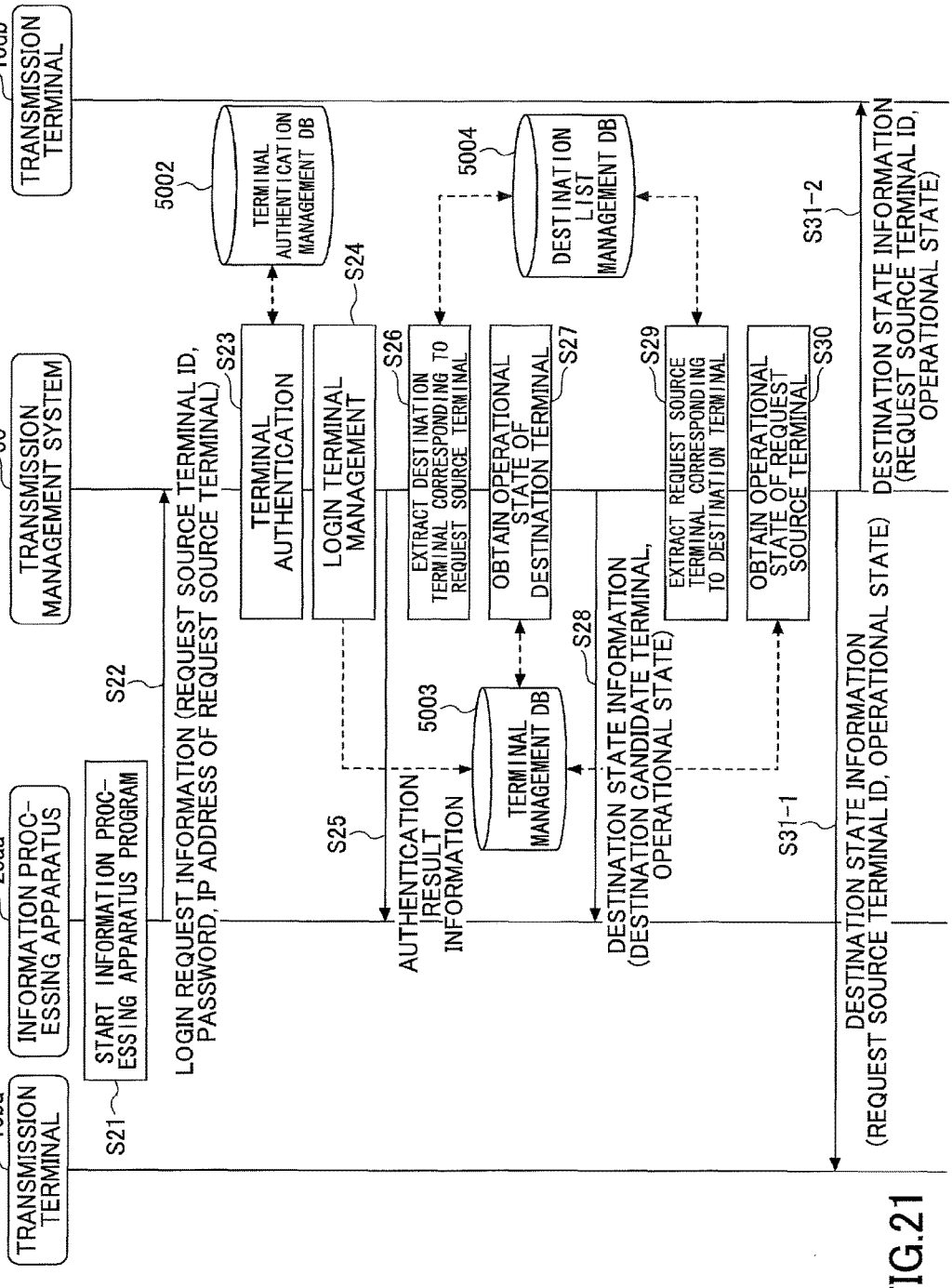

10ba
TRANSMISSION TERMINAL
20aa
INFORMATION PROCESSING APPARATUS
50
TRANSMISSION MANAGEMENT SYSTEM
10db
TRANSMISSION TERMINAL
S21
START INFORMATION PROCESSING APPARATUS PROGRAM
S22
LOGIN REQUEST INFORMATION (REQUEST SOURCE TERMINAL ID, PASSWORD, IP ADDRESS OF REQUEST SOURCE TERMINAL)
S23
TERMINAL AUTHENTICATION
5002
TERMINAL AUTHENTICATION MANAGEMENT DB
S24
LOGIN TERMINAL MANAGEMENT
S25
AUTHENTICATION RESULT INFORMATION
5003
TERMINAL MANAGEMENT DB
S26
EXTRACT DESTINATION TERMINAL CORRESPONDING TO REQUEST SOURCE TERMINAL
5004
DESTINATION LIST MANAGEMENT DB
S27
OBTAIN OPERATIONAL STATE OF DESTINATION TERMINAL
S28
DESTINATION STATE INFORMATION (DESTINATION CANDIDATE TERMINAL, OPERATIONAL STATE)
S29
EXTRACT REQUEST SOURCE TERMINAL CORRESPONDING TO DESTINATION TERMINAL
S30
OBTAIN OPERATIONAL STATE OF REQUEST SOURCE TERMINAL
S31-1
DESTINATION STATE INFORMATION (REQUEST SOURCE TERMINAL ID, OPERATIONAL STATE)
S31-2
DESTINATION STATE INFORMATION (REQUEST SOURCE TERMINAL ID, OPERATIONAL STATE)

FIG.21

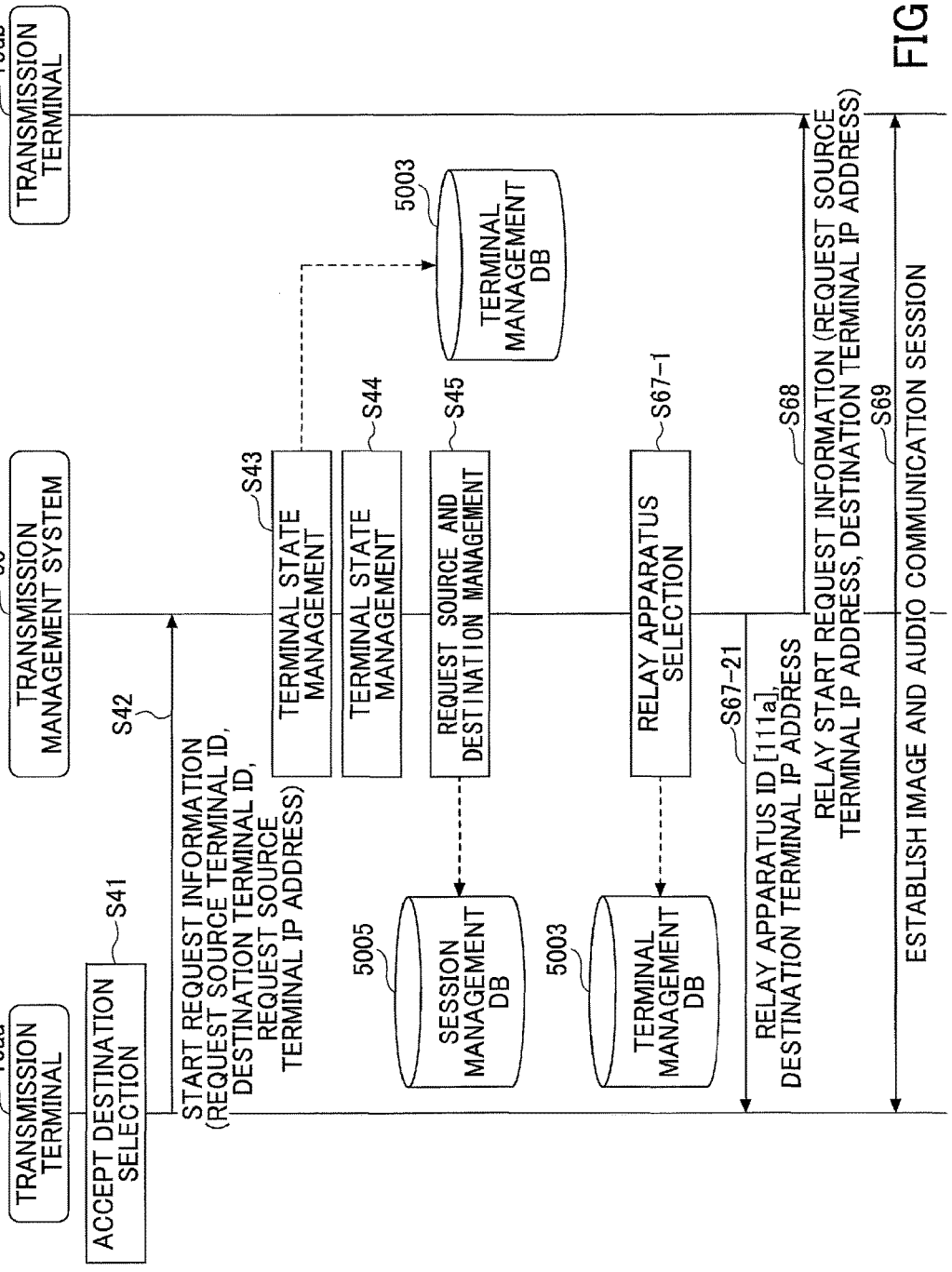

10aa
TRANSMISSION TERMINAL
ACCEPT DESTINATION SELECTION
S41
50
TRANSMISSION MANAGEMENT SYSTEM
S42
START REQUEST INFORMATION (REQUEST SOURCE TERMINAL ID, DESTINATION TERMINAL ID, REQUEST SOURCE TERMINAL IP ADDRESS)
S43
TERMINAL STATE MANAGEMENT
S44
TERMINAL STATE MANAGEMENT
S45
REQUEST SOURCE AND DESTINATION MANAGEMENT
5005
SESSION MANAGEMENT DB
5003
TERMINAL MANAGEMENT DB
S67-1
RELAY APPARATUS SELECTION
S67-21
RELAY APPARATUS ID [111a], DESTINATION TERMINAL IP ADDRESS
S68
RELAY START REQUEST INFORMATION (REQUEST SOURCE TERMINAL IP ADDRESS, DESTINATION TERMINAL IP ADDRESS)
S69
ESTABLISH IMAGE AND AUDIO COMMUNICATION SESSION
10db
TRANSMISSION TERMINAL
5003
TERMINAL MANAGEMENT DB

FIG.22

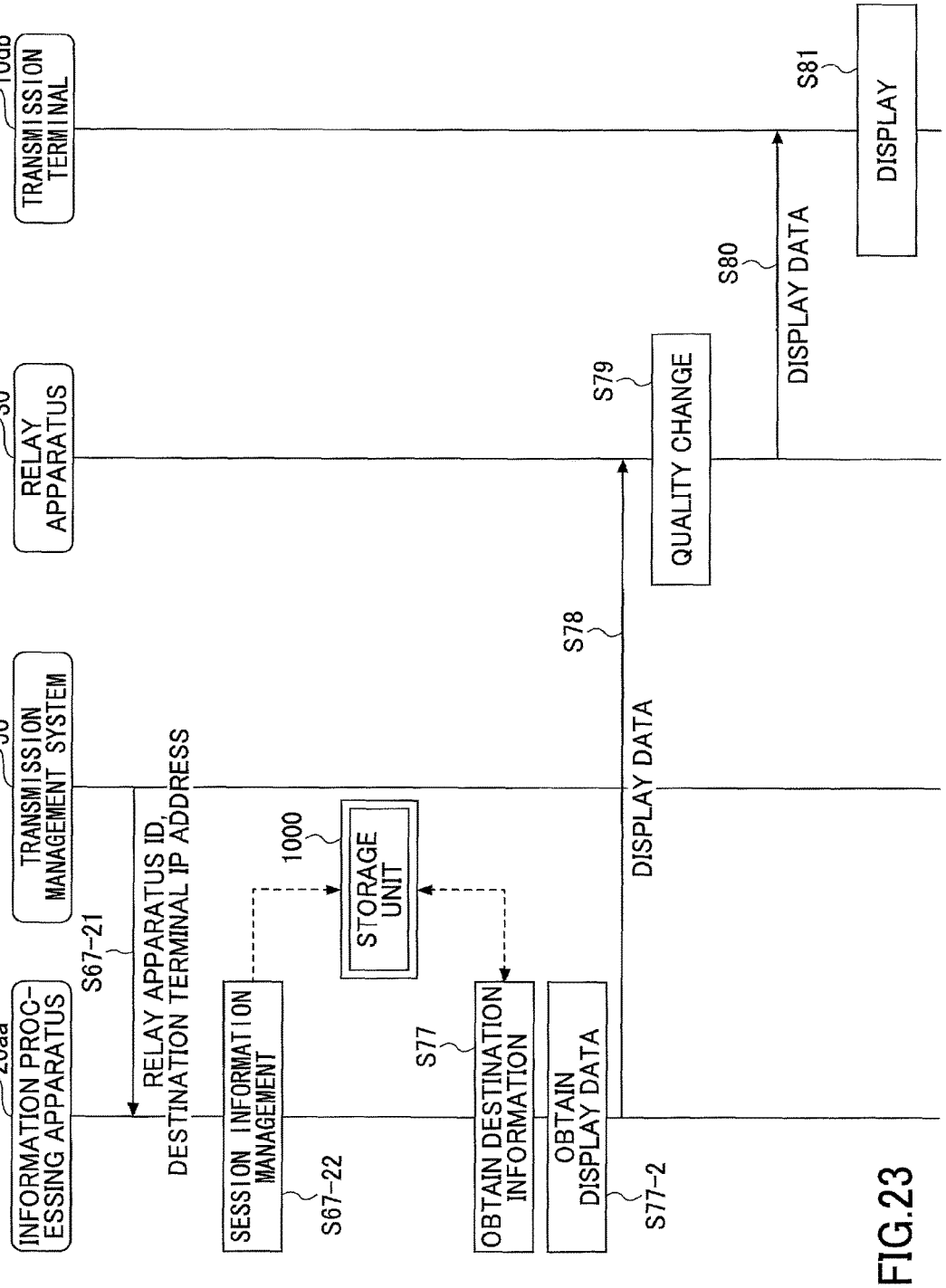
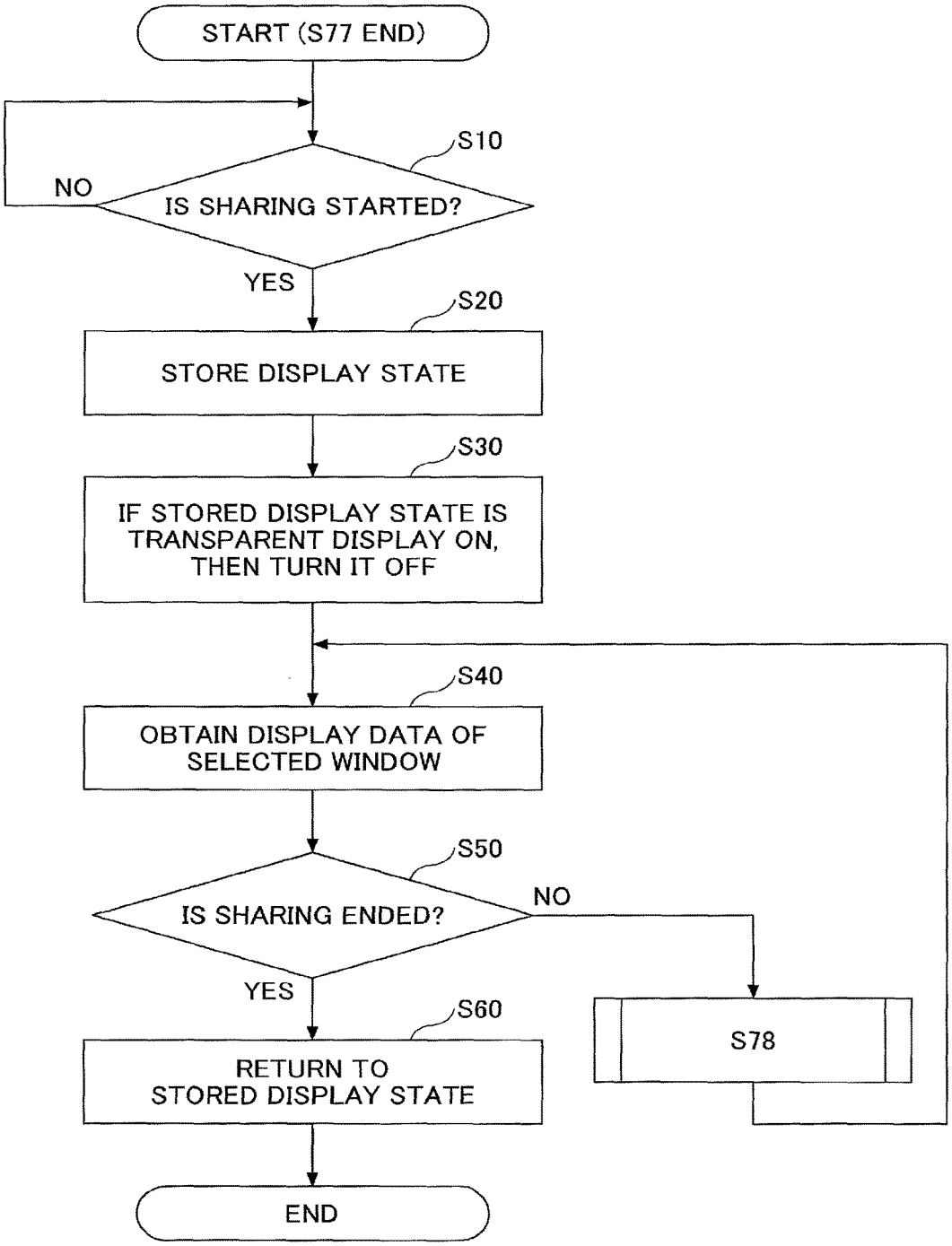

20aa
INFORMATION PROCESSING APPARATUS
50
TRANSMISSION MANAGEMENT SYSTEM
30
RELAY APPARATUS
10db
TRANSMISSION TERMINAL
S67-21
RELAY APPARATUS ID, DESTINATION TERMINAL IP ADDRESS
SESSION INFORMATION MANAGEMENT
S67-22
1000
STORAGE UNIT
S77
OBTAIN DESTINATION INFORMATION
OBTAIN DISPLAY DATA
S77-2
S78
DISPLAY DATA
S79
QUALITY CHANGE
S80
DISPLAY DATA
S81
DISPLAY

FIG.23

FIG.24


START (S77 END)
S10
NO
IS SHARING STARTED?
YES
S20
STORE DISPLAY STATE
S30
IF STORED DISPLAY STATE IS TRANSPARENT DISPLAY ON, THEN TURN IT OFF
S40
OBTAIN DISPLAY DATA OF SELECTED WINDOW
S50
IS SHARING ENDED?
NO
YES
S78
S60
RETURN TO STORED DISPLAY STATE
END

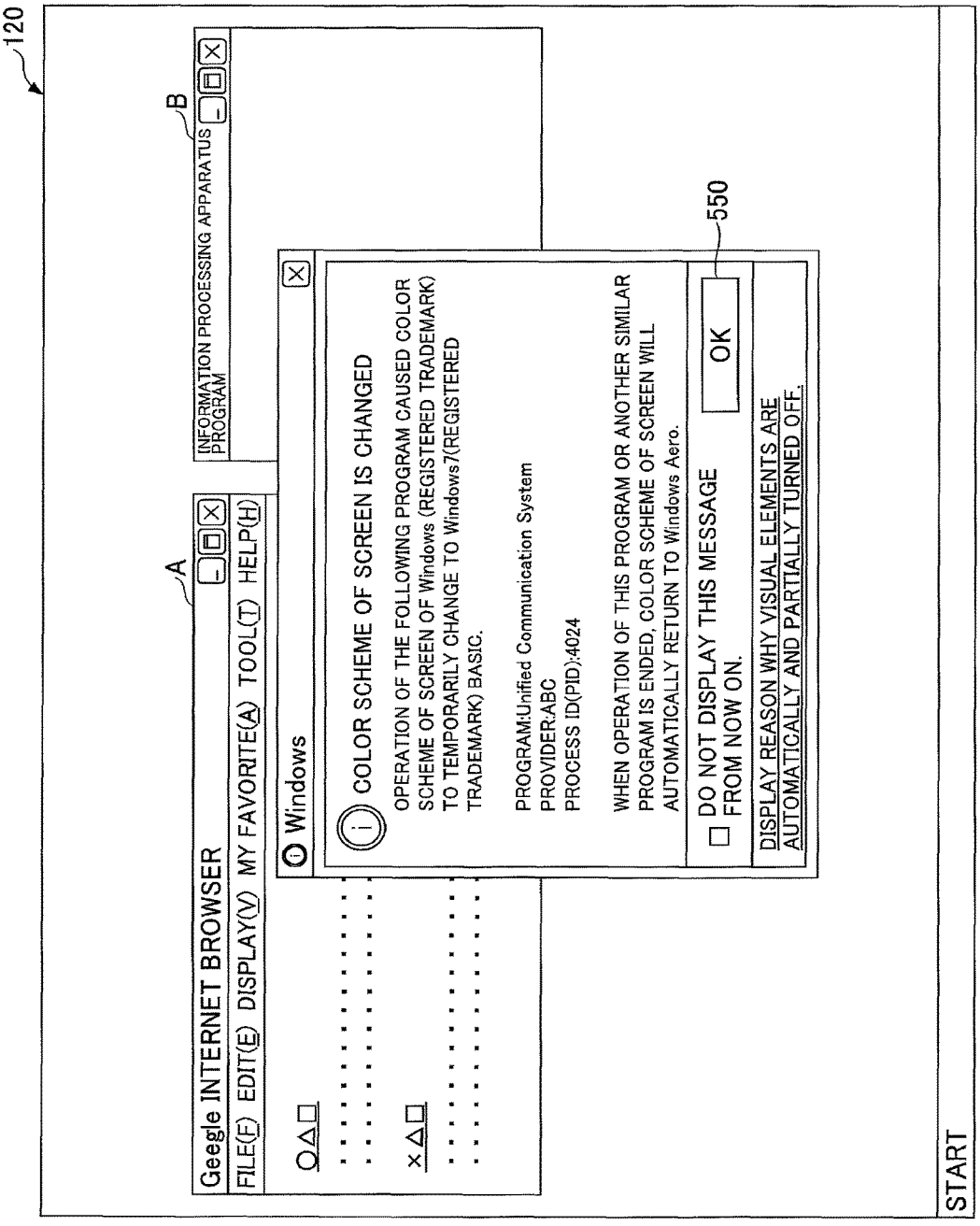

120
A
B
Geegle INTERNET BROWSER
FILE(F) EDIT(E) DISPLAY(V) MY FAVORITE(A) TOOL(T) HELP(H)
INFORMATION PROCESSING APPARATUS PROGRAM
Windows
COLOR SCHEME OF SCREEN IS CHANGED
OPERATION OF THE FOLLOWING PROGRAM CAUSED COLOR SCHEME OF SCREEN OF Windows (REGISTERED TRADEMARK) TO TEMPORARILY CHANGE TO Windows7(REGISTERED TRADEMARK) BASIC.
PROGRAM:Unified Communication System
PROVIDER:ABC
PROCESS ID(PID):4024
WHEN OPERATION OF THIS PROGRAM OR ANOTHER SIMILAR PROGRAM IS ENDED, COLOR SCHEME OF SCREEN WILL AUTOMATICALLY RETURN TO Windows Aero.
DO NOT DISPLAY THIS MESSAGE FROM NOW ON.
OK
550
DISPLAY REASON WHY VISUAL ELEMENTS ARE AUTOMATICALLY AND PARTIALLY TURNED OFF.
START

FIG.25

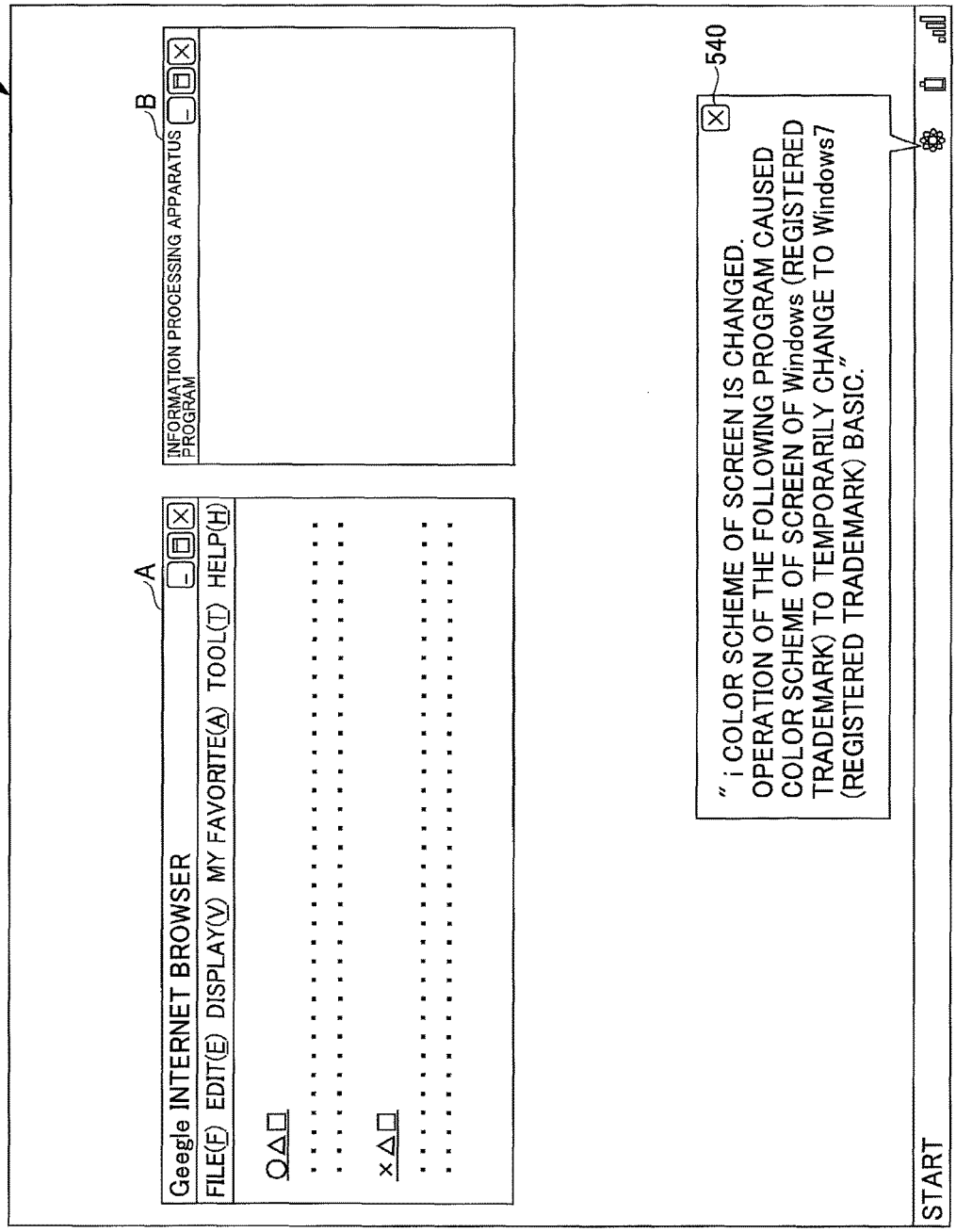

120
A
Geegle INTERNET BROWSER
FILE(F) EDIT(E) DISPLAY(V) MY FAVORITE(A) TOOL(T) HELP(H)
○△□
× △□
B
INFORMATION PROCESSING APPARATUS PROGRAM
540
" i COLOR SCHEME OF SCREEN IS CHANGED.
OPERATION OF THE FOLLOWING PROGRAM CAUSED
COLOR SCHEME OF SCREEN OF Windows (REGISTERED
TRADEMARK) TO TEMPORARILY CHANGE TO Windows7
(REGISTERED TRADEMARK) BASIC."
START

FIG.26

FIG.27

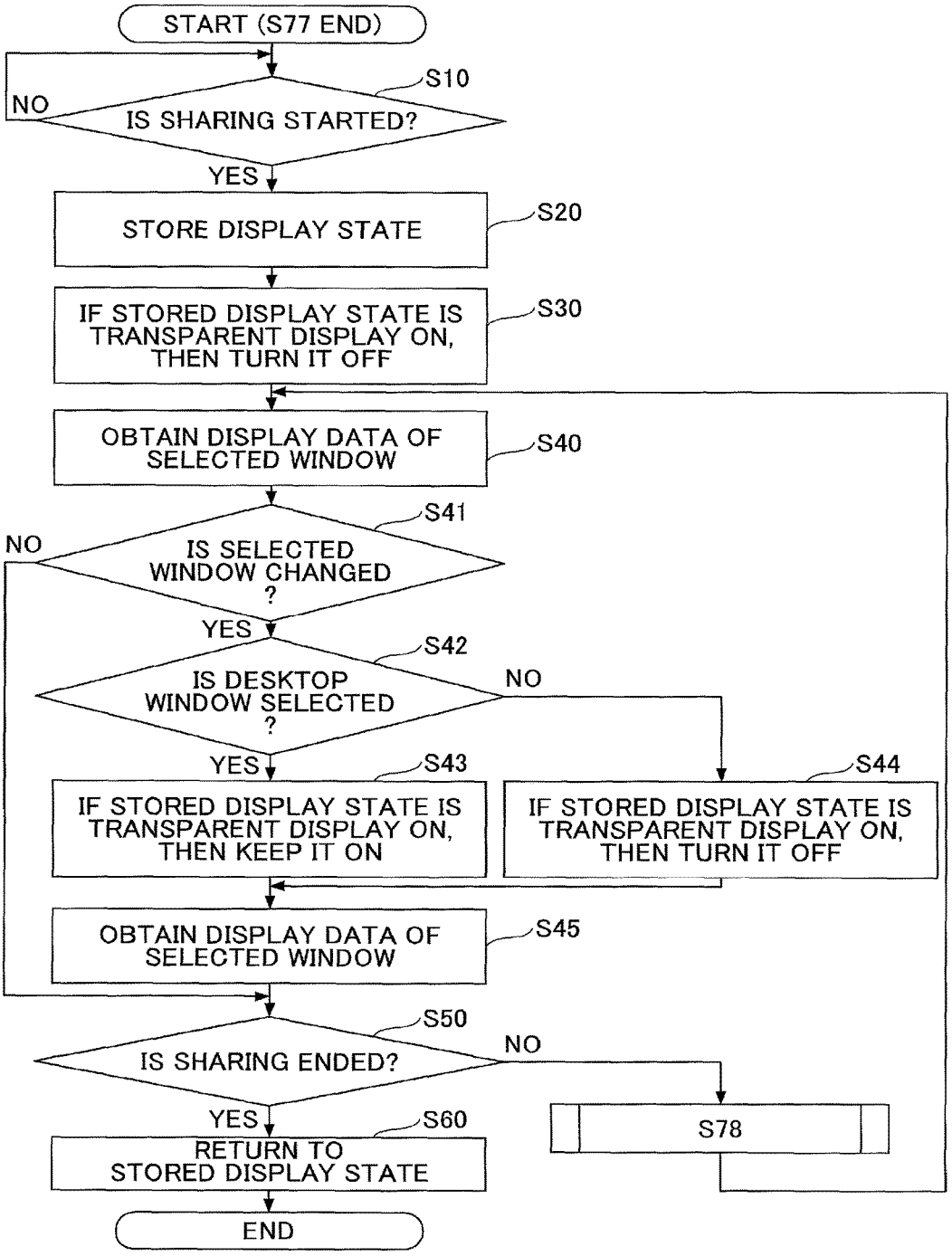

START (S77 END)
S10
NO
IS SHARING STARTED?
YES
STORE DISPLAY STATE
S20
IF STORED DISPLAY STATE IS TRANSPARENT DISPLAY ON, THEN TURN IT OFF
S30
OBTAIN DISPLAY DATA OF SELECTED WINDOW
S40
S41
NO
IS SELECTED WINDOW CHANGED ?
YES
S42
IS DESKTOP WINDOW SELECTED ?
NO
YES
S43
IF STORED DISPLAY STATE IS TRANSPARENT DISPLAY ON, THEN KEEP IT ON
S44
IF STORED DISPLAY STATE IS TRANSPARENT DISPLAY ON, THEN TURN IT OFF
OBTAIN DISPLAY DATA OF SELECTED WINDOW
S45
S50
IS SHARING ENDED?
NO
YES
S60
RETURN TO STORED DISPLAY STATE
S78
END

FIG.28

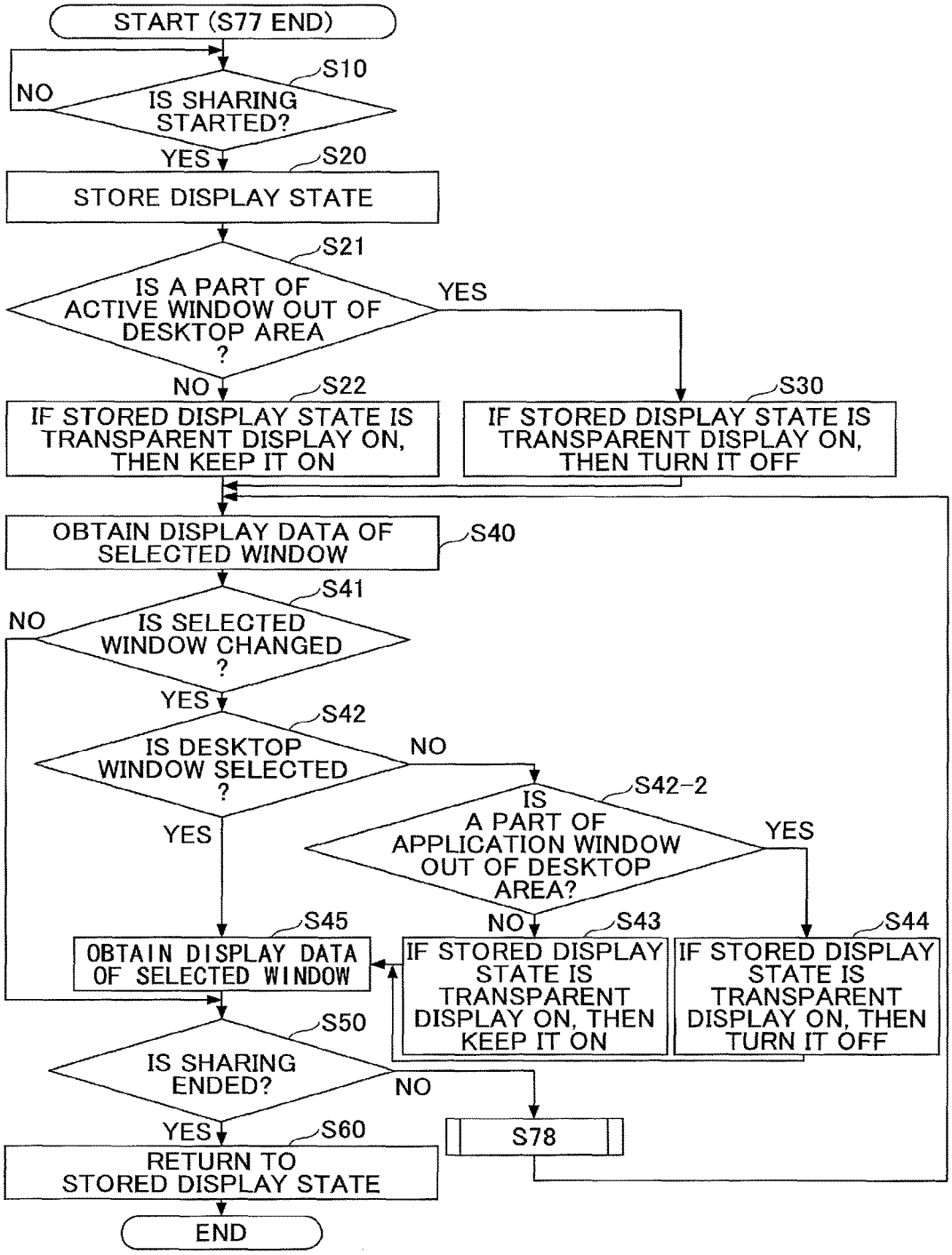

START (S77 END)
S10
NO
IS SHARING STARTED?
YES
S20
STORE DISPLAY STATE
S21
IS A PART OF ACTIVE WINDOW OUT OF DESKTOP AREA ?
YES
NO
S22
IF STORED DISPLAY STATE IS TRANSPARENT DISPLAY ON, THEN KEEP IT ON
S30
IF STORED DISPLAY STATE IS TRANSPARENT DISPLAY ON, THEN TURN IT OFF
OBTAIN DISPLAY DATA OF SELECTED WINDOW
S40
S41
NO
IS SELECTED WINDOW CHANGED ?
YES
S42
IS DESKTOP WINDOW SELECTED ?
NO
YES
S42-2
IS A PART OF APPLICATION WINDOW OUT OF DESKTOP AREA?
YES
NO
S45
OBTAIN DISPLAY DATA OF SELECTED WINDOW
S43
IF STORED DISPLAY STATE IS TRANSPARENT DISPLAY ON, THEN KEEP IT ON
S44
IF STORED DISPLAY STATE IS TRANSPARENT DISPLAY ON, THEN TURN IT OFF
S50
IS SHARING ENDED?
NO
YES
S60
RETURN TO STORED DISPLAY STATE
S78
END

FIG.29

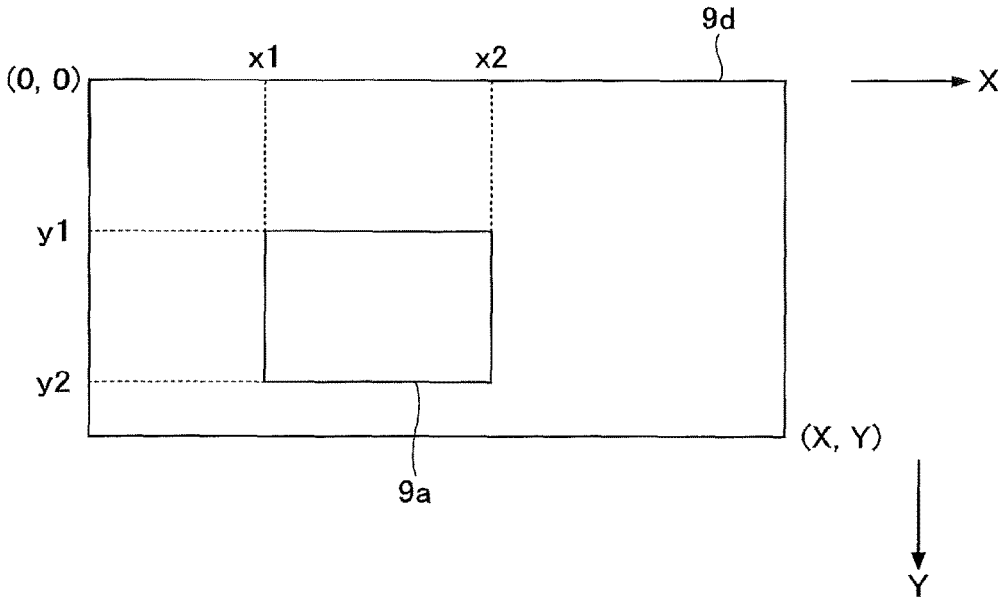


FIG.30

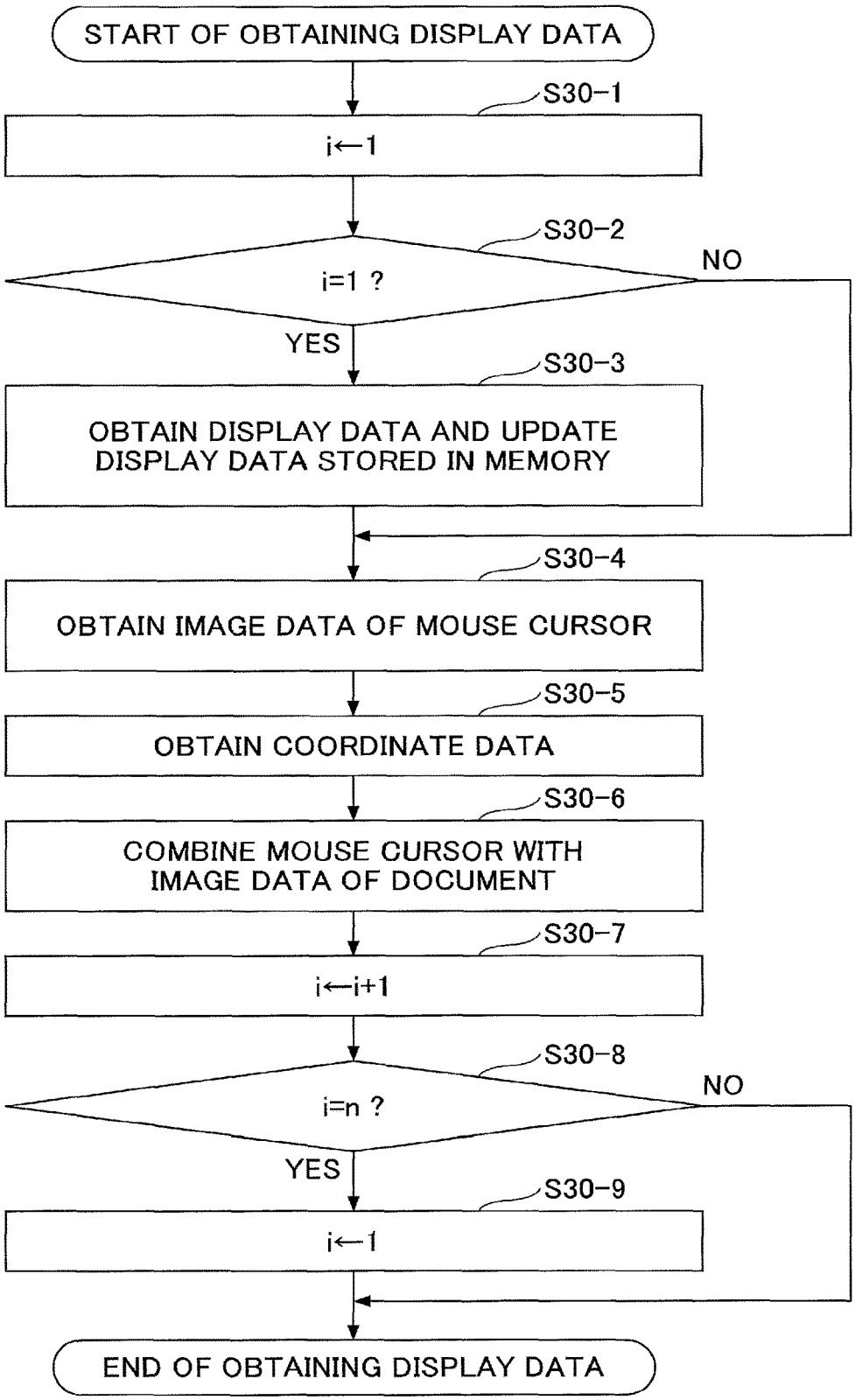

START OF OBTAINING DISPLAY DATA
S30-1
i←1
S30-2
i=1 ?
NO
YES
S30-3
OBTAIN DISPLAY DATA AND UPDATE DISPLAY DATA STORED IN MEMORY
S30-4
OBTAIN IMAGE DATA OF MOUSE CURSOR
S30-5
OBTAIN COORDINATE DATA
S30-6
COMBINE MOUSE CURSOR WITH IMAGE DATA OF DOCUMENT
S30-7
i←i+1
S30-8
i=n ?
NO
YES
S30-9
i←1
END OF OBTAINING DISPLAY DATA

FIG.31

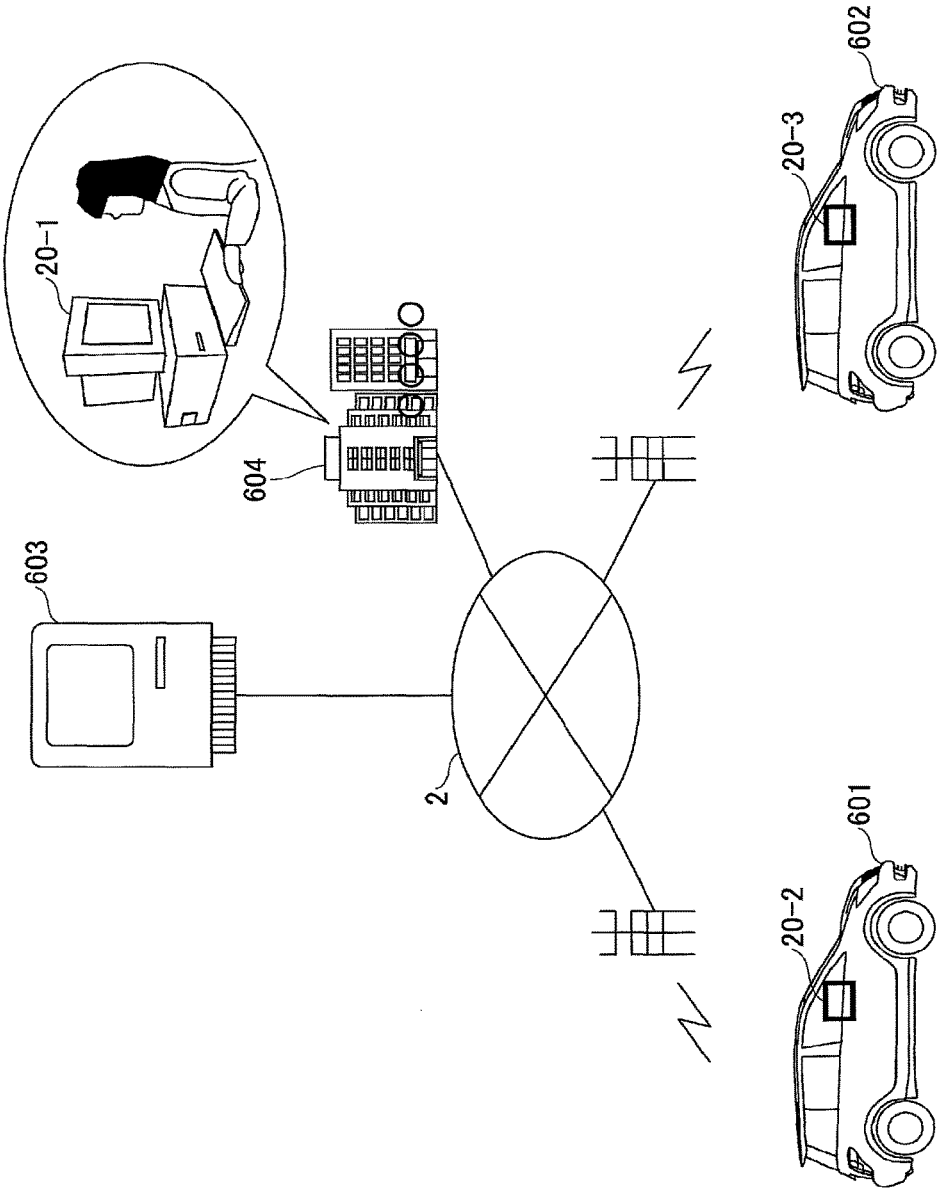
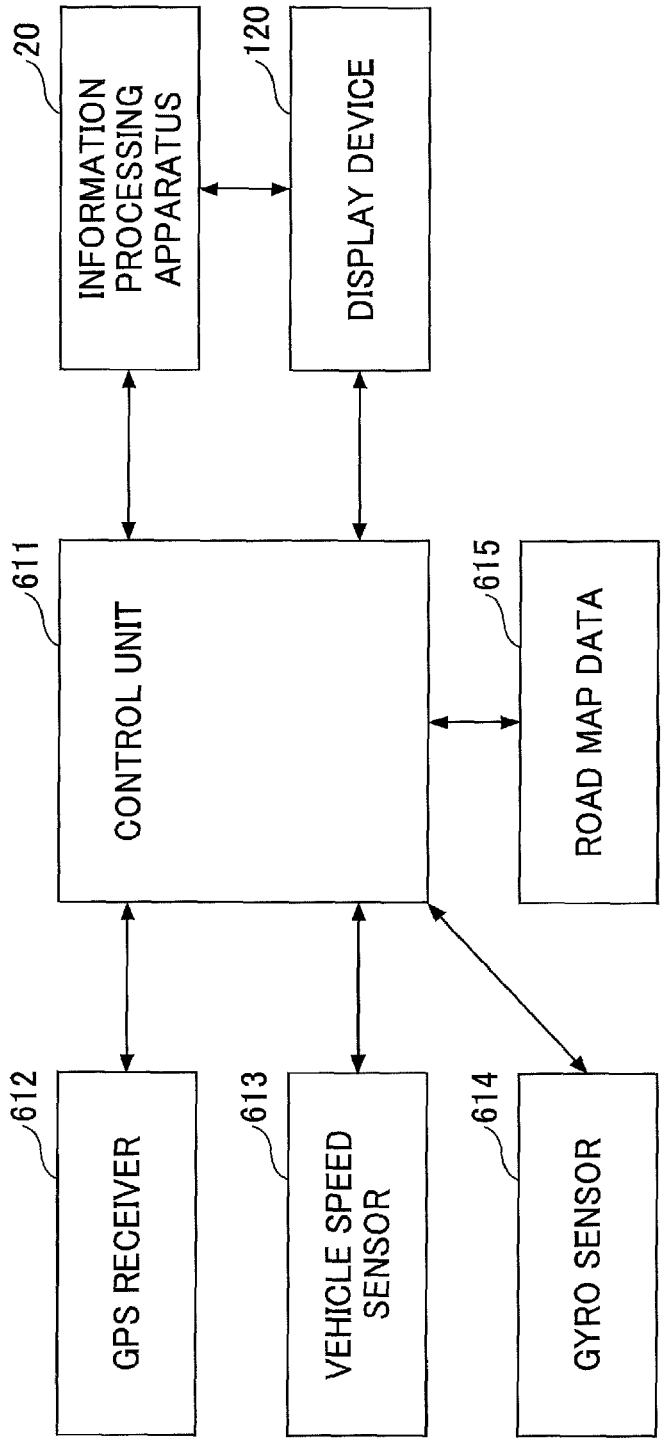


FIG.32


20
INFORMATION PROCESSING APPARATUS
120
DISPLAY DEVICE
611
CONTROL UNIT
615
ROAD MAP DATA
612
GPS RECEIVER
613
VEHICLE SPEED SENSOR
614
GYRO SENSOR

INFORMATION PROCESSING APPARATUS AND TRANSMISSION SYSTEM FOR REDUCING SCREEN FAILURE WHEN DISPLAY DATA IS TRANSMITTED TO A DESTINATION

CROSS-REFERENCE TO RELATED APPLICATIONS

This application is a continuation application filed under 35 U.S.C. 111(a) claiming the benefit under 35 U.S.C. 120 and 365(c) of a PCT International Application No. PCT/JP2014/083914 filed on Dec. 22, 2014, which is based upon and claims the benefit of priority of the prior Japanese Patent Application No. 2013-267983 filed on Dec. 25, 2013 with the Japanese Patent Office, the entire contents of which are hereby incorporated by reference.

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to an information processing apparatus, or the like, capable of communicating with another apparatus via a network.

2. Description of the Related Art

A transmission system for performing a video conference or the like with a remote place via a communication network such as the Internet has become popular. A transmission terminal transmits image data taken by a camera and audio data collected by a mike to a destination transmission terminal. Each terminal displays an image on a display device and outputs sound from a speaker.

Further, when a video conference is held by using a transmission terminal, a user participating in the conference can share, with another user of the conference, display data of a conference document, etc., displayed on a display device of an external input apparatus such as a personal computer (PC) which is used separately from the transmission terminal (refer to, for example, Patent Document 1).

In the transmission system, there is a case where a PC is used as a conference terminal operated by a user instead of a case where a dedicated transmission terminal is used as a conference terminal. For example, when a video conference program is installed in a PC, the PC can perform communications or execute processes for a video conference with another PC or dedicated terminal. Therefore, even when a user does not have a dedicated terminal, the user can participate in a video conference by having a video conference program installed in the user's PC or a PC at a visiting place.

However, because an operating system (OS) and other applications may be running on the PC, the load of the PC may be increased. As a result, there is a problem of flickering screen of the PC when the video conference program is running on the PC and the PC transmits audio data, video data, and display data to a destination terminal.

The present invention has been made in view of the above problem. It is an object of the present invention to provide an information processing apparatus in which screen failure is reduced which occurs when display data is transmitted to a destination.

CITATION LIST

Patent Document

[Patent Document 1] Japanese Laid-Open Patent Application No. 2011-254442

SUMMARY OF THE INVENTION

An information processing apparatus capable of communicating with another apparatus via a network is provided. The information processing apparatus includes a display unit configured to display an image on a display apparatus included in or connected to the information processing apparatus; a transmission unit configured to transmit image data of the image displayed on the display apparatus to the other apparatus; and a reducing unit configured to reduce a process load involved in displaying the image on the display apparatus in the case where the transmission unit transmits the image data to the other apparatus.

An information processing apparatus can be provided in which screen failure is reduced which occurs when display data is transmitted to a destination.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a schematic diagram of an overall structure of a transmission system according to an embodiment of the present invention.

FIG. **2** is an example of a hardware structure diagram of an information processing apparatus included in the transmission system.

FIG. **3** is an example of a hardware structure diagram of a transmission management system included in the transmission system.

FIG. **4** is an example of a functional block diagram of an information processing apparatus, a relay apparatus, and a transmission management system included in the transmission system.

FIG. **5**A is a drawing illustrating low resolution.

FIG. **5**B is a drawing illustrating medium resolution.

FIG. **5**C is a drawing illustrating high resolution.

FIG. **6** is a drawing illustrating an example of a change quality management table.

FIG. **7** is a drawing illustrating an example of a relay apparatus management table.

FIG. **8** is a drawing illustrating an example of a terminal authentication management table.

FIG. **9** is a drawing illustrating an example of a terminal management table.

FIG. **10** is a drawing illustrating an example of a destination list management table.

FIG. **11** is a drawing illustrating an example of a session management table.

FIG. **12** is a drawing illustrating an example of a quality management table.

FIG. **13** is a drawing illustrating an example of a desktop screen displayed on a display device.

FIG. **14** is a drawing illustrating an example of a login screen displayed by a program for an information processing apparatus.

FIG. **15** is a drawing illustrating an example of an application window (main screen) displayed by a program for an information processing apparatus.

FIG. **16** is a drawing of an example illustrating display data sharing.

FIG. **17** is a drawing of an example illustrating combining an icon image of a mouse cursor with display data.

FIG. **18** is a drawing of an example illustrating combining an icon image of a mouse cursor with display data.

FIG. **19** is a flowchart of an example of a procedure of a display data obtaining unit for combining an icon image of a mouse cursor with the display data.

FIG. **20** is a sequence diagram illustrating an example of a process for controlling status information indicating operational states of relay apparatuses transmitted from the relay apparatuses to a transmission management system.

FIG. **21** is a sequence diagram illustrating an example of a preparation stage process for starting communications between transmission terminals.

FIG. **22** is a sequence diagram illustrating an example of a process of a transmission terminal for establishing a session.

FIG. **23** is a sequence diagram illustrating an example of a process for causing a destination transmission terminal of the conference to display the display data displayed by an external input apparatus.

FIG. **24** is a flowchart of an example of a procedure for obtaining display data.

FIG. **25** is a drawing illustrating an example of a message which is displayed when transparent display is switched OFF in step S**30**.

FIG. **26** is a drawing illustrating another example of a message which is displayed when transparent display state is switched OFF.

FIG. **27** is a flowchart of an example of a procedure for obtaining display data (Example 2).

FIG. **28** is a flowchart of an example of a procedure for obtaining display data (Example 3).

FIG. **29** is a drawing of an example illustrating a coordinate system used for determining whether an application window is out of the desktop area.

FIG. **30** is a flowchart of an example of a process which replaces a process of "switching OFF the transparent display if the transparent display of the stored display status is ON" in step S**30** of FIG. **24**.

FIG. **31** is a drawing illustrating an example of a system structure diagram in the case where the information processing apparatus or the transmission terminal is used as a car-navigation apparatus.

FIG. **32** is a structure diagram of an example of a car-navigation apparatus.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

In the following, an embodiment of the present invention will be described referring to the drawings. It should be noted that the technical scope of the present invention should not be limited to the embodiment.

Embodiment 1

FIG. **1** is a schematic diagram of an overall structure of a transmission system **1** according to an embodiment 1. In the following, referring to FIG. **1**, the embodiment 1 will be described. In the embodiment 1, an information processing apparatus **20** will be described. In the case where a transparent display of the information processing apparatus **20** is set ON, a display load of the information processing apparatus tends to increase easily when audio data, image data and display data are transmitted to a destination terminal, and thus, the transparent display is switched OFF. With the above operation, flickering of a screen during display data sharing can be suppressed.

In general, a transmission system includes a data providing system in which content data is transmitted from a first transmission terminal to a second transmission terminal in one direction via a transmission management system, and a communication system in which information including emotional information is transmitted to each other among a plurality of transmission terminals via a transmission management system. The communication system is used for transmitting information including emotional information among a plurality of communication terminals (corresponding to "information processing apparatus" and "transmission terminal") via a communication management system (corresponding to "transmission management system"). As an example of the communication system, a video conference system, a video telephone system, an audio conference system, an audio telephone system, a personal computer (PC) screen sharing system, or the like can be listed.

In the present embodiment, it is assumed that a video conference system or an interactive white board (IWB) system is an example of the communication system, a video conference management system is an example of the communication management system, and a video conference terminal is an example of the communication terminal. A transmission system, a transmission management system, an information processing apparatus and a transmission terminal will be described. In other words, a transmission terminal and a transmission management system of an embodiment may be applied not only to a video conference system, but also to a communication system or a transmission system. It should be noted that the transmission system **1** is an example of a claimed information processing system.

The transmission system **1** of an embodiment (refer to FIG. **1**) includes information processing terminals **20***aa*, **20***ah*, **20***ca* and **20***cb*, transmission terminals **10***ba*, **10***bb*, **10***da*, and **10***db*, display devices **120***ba*, **120***bb*, **120***da* and **120***db* for the corresponding transmission terminals **10***ba*, . . . , **10***db*, external input apparatuses **40***ba*, **40***bb*, **40***da* and **40***db* such as PCs connected to the corresponding transmission terminals **10***ba*, . . . , **10***db*, relay apparatuses **30***a*, **30***b*, **30***c* and **30***d*, a transmission management system **50**, and a program providing system **90** and a maintenance system **100**. The information processing apparatuses **20***aa*, **20***ab*, **20***ca* and **20***cb* include display devices **120***aa*, **120***ab*, **120***ca*, and **120***cb*, respectively.

It should be noted that, unless otherwise noted, any one of the information processing apparatuses **20***aa*, . . . , **20***cb* is referred to as "information processing apparatus **20**", any one of the transmission terminals **10***ba*, . . . , **10***db* is referred to as "transmission terminal **10**", any one of the display devices **120***aa*, . . . , **120***db* is referred to as "display device **120**", any one of the external input apparatuses **40***ba*, . . . , **40***db* is referred to as "external input apparatus **40**", and any one of the relay apparatuses **30***a*, . . . , **30***d* is referred to as "relay apparatus **30**". Further, the display device **120** is an example of a display apparatus of the transmission terminal **10**.

An information processing apparatus **20** transmits and receives image data, audio data, etc., to and from another information processing apparatus **20** or a transmission terminal **10**. Further, a transmission terminal **10** transmits and receives image data, audio data, etc., to and from another transmission terminal **10** or an information processing apparatus **20**. In an embodiment, an image of the image data is a video image. However, the image may be not only a video image but also a still image. Further, the image of the image data may include both a video image and a still image. A relay apparatus **30** is used for relaying image data and audio data between an information processing apparatus **20** and a transmission terminal **10**. In the case where display data displayed on an image processing apparatus **20** or an external input apparatus **40** is shared, the relay apparatus **30** relays the display data. The transmission management sys-

tem **50** is used for centralized management of the information processing apparatuses **20**, the transmission terminals **10** and the relay apparatuses **30**.

An external input apparatus **40** is connected to a transmission terminal **10**, and transmits to the transmission terminal **10** display data representing an image displayed on the display apparatus (a display device **216** which will be described later) of the external input apparatus **40**.

Further, routers **70***a*, **70***b*, **70***c*, **70***d*, **70***e* and **70***f* are used for selecting an optimal route for transmitting and receiving image data and audio data. In the following description, unless otherwise noted, any of the routers **70***a*, . . . , **70***f* is referred to as "router **70**". Further, the program providing system **90** includes a hard disk (HD) (not shown). In the HD, an information processing apparatus program for an information processing apparatus **20** to realize various functions or various means, a transmission terminal program for a transmission terminal **10** to realize various functions or various means, a relay apparatus program for a relay apparatus **30** to realize various functions or various means, and a transmission management program for a transmission management system **50** to realize various functions or various means are stored. The program providing system **90** is capable of transmitting the information processing apparatus program, the transmission terminal program, the relay apparatus program, and the transmission management program stored in the HD to the information processing apparatuses **20**, the transmission terminals **10**, the relay apparatuses **30** and the transmission management system **50**, respectively.

Further, the information processing apparatuses **20***aa* and **20***ab*, the relay apparatus **30***a* and the router **70***a* are connected to each other and capable of communicating with each other via a local area network (LAN) **2***a*. The transmission terminals **10***ba* and **10***bb*, the relay apparatus **30***b* and the router **70***b* are connected to each other and capable of communicating with each other via LAN **2***b*. The LAN **2***a* and the LAN **2***b* are connected to each other and capable of communicating with each other via a dedicated line **2***ab* including the router **70***c*. The LAN **2***a* and the LAN **2***b* are included in a predetermined area A. For example, the area A is Japan, the LAN **2***a* is included in an office in Tokyo, and the LAN **2***b* is included in an office in Osaka.

The information processing apparatuses **20***ca* and **20***cb*, the relay apparatus **30***c* and the router **70***d* are connected to each other and capable of communicating with each other a LAN **2***c*. The transmission terminals **10***da* and **10***db*, the relay apparatus **30***d* and the router **70***e* are connected to each other and capable of communicating with each other via a LAN **2***d*. Further, the LAN **2***c* and the LAN **2***d* are connected to each other and capable of communicating with each other by a dedicated line **2***cd* including the router **70***f*. The LAN **2***c* and the LAN **2***d* are included in a predetermined area B. For example, the area B is the United States, the LAN **2***c* is included in an office in New York, and the LAN **2***d* is included in an office in Washington, D.C. The area A and the area B are connected to each other and capable of communicating with each other via the Internet **2***i* through the respective routers **70***c* and **70***f*.

Further, the transmission management system **50**, the program providing system **90** and the maintenance system **100** are connected to the transmission terminal **10** and the relay apparatus **30** and capable of communicating with the transmission terminal **10** and the relay apparatus **30** via the Internet **2***i*. The transmission management system **50**, the program providing system **90** and the maintenance system **100** may be included in the area A or the area B, or may be included in an area other than the areas A and B.

In an embodiment, the LAN **2***a*, the LAN **2***b*, the dedicated line **2***ab*, the Internet **2***i*, the dedicated line **2***cd*, the LAN **2***c*, and the LAN **2***d* are included in a communication network **2**.

Further, in FIG. **1**, a set of four numbers indicated under each of the information processing apparatuses **20**, each of the transmission terminals **10**, each of the relay apparatuses **30**, the transmission management system **50**, each of the routers **70**, the program providing system **90** and the maintenance system **100** illustrates a typical IP address of Internet protocol version 4 (IPv4) in a simplified manner. For example, an IP address of the information processing apparatus **20***aa* is "1. 2. 1. 3". Further, instead of IPv4, IPv6 may be used. But for the purpose of simplicity, IPv4 is used in the description.

<<Hardware Structure>>

Next, a hardware structure according to an embodiment will be described.

FIG. **2** is a hardware structure diagram of an information processing apparatus **20** included in the transmission system **1** according to the embodiment. As shown in FIG. **2**, the information processing apparatus **20** includes a central processing unit (CPU) **101** for controlling an entire operation of the information processing apparatus **20**, a read only memory (ROM) **102**, a random access memory (RAM) **103** used for a work area of the CPU **101**, a flash memory **104** for storing data including image data, audio data, etc., a solid state drive (SSD) **105** used for writing and reading data to and from the flash memory **104** according to the control of the CPU **101**, in which memory **104** an information processing apparatus program **119** is stored, a media drive **107** used for writing (storing) and reading data to and from recording media **106** such as a flash memory, an operation button **108** used for accepting a user operation, a power supply switch **109** used for switching ON/OFF the power supply of the information processing apparatus **20**, a network I/F **111** used for data transmission via the communication network **2** which will be described later, a camera **112** used for taking an image of an object and obtaining image data according to the control of the CPU **101**, an imaging element I/F **113** for driving the camera **112**, a mike **114** used for inputting audio, a speaker **115** used for outputting the audio, an audio input output I/F **116** used for processing input and output of an audio signal between the mike **114** and the speaker **115** according to the control of the CPU **101**, a display I/F **117** for transmitting image data to the display device **120** according to the control of the CPU **101**, an external device I/F **118** used for transmitting and receiving data to and from an external device, and a bus line **110** including an address bus and a data bus for electrically connecting the above elements with each other.

It should be noted that the recording media **106** can be attached and detached to and from the information processing apparatus **20**. Further, it is not limited to the flash memory **104** that is used, and, electrically erasable and programmable ROM (EEPROM), or the like may be used as long as it is a non-volatile memory to/from which data is written/read according to the control of the CPU **101**. Further, the camera **112** includes a solid-state image sensing device used for digitizing an image (video) of an object by converting light to electricity, such as a charge coupled device (CCD) element and a complementary metal oxide semiconductor (CMOS) element. Further, other than the SSD **105**, a hard disk drive (HDD) may be used.

Further, the display device **120** includes a liquid crystal element, an organic EL element, etc., used for displaying display data, an image of an object, an icon for an operation, or the like. The display device **120** may be an external type or a built-in type.

Further, the information processing apparatus program may be recorded in a computer-readable recording medium as a file in an installable format or an executable format, and may be distributed.

It should be noted that the camera **112**, the mike **114**, and the speaker **115** may not be built-in types and may be external types.

Further, because the transmission terminal **10** has a similar hardware structure to that of the information processing apparatus **20**, the duplicate descriptions will be omitted. It should be noted that the SSD **105** of the transmission terminal **10** stores a transmission terminal program for controlling the transmission terminal **10**.

The information processing apparatus **20** and the transmission terminal **10** may be a PC, a smartphone, a tablet terminal, a mobile telephone, etc.

FIG. **3** is a hardware structure diagram of a transmission management system **50** included in the transmission system **1** according to an embodiment. The transmission management system **50** includes a CPU **201** for controlling overall operations of the transmission management system **50**; a ROM **202** used for storing a transmission management program; a RAM **203** used for a work area of the CPU **201**; a hard disk (HD) **204** for storing various data, a HDD **205** for writing and reading various data to and from the HD **204** according to the control of the CPU **201**; a media drive **207** for writing (storing) and reading data to and from recording media **206** including a flash memory; a display I/F **208** for displaying on a display device **216** information including a cursor, a menu, a window, a character, or an image; a network I/F **209** for performing data transmission by using the communication network **2** which will be described later; a keyboard **211** including keys for inputting a character, a numerical value, various instructions, etc.; a mouse **212** for selecting and executing the various instructions, selecting a process target, moving a mouse cursor, or the like; a CD-ROM drive **214** for writing and reading data to and from a compact disc read only memory (CD-ROM) **213** as an example of a detachable recording medium; an external device I/F **215** for transmitting and receiving information to and from an external device; and a bus line **210** such as an address bus, a data bus, etc., for electrically connecting the above elements. It should be noted that a display device **216** is also an example of a display apparatus of the external input apparatus **40**.

Further, the transmission management program may be recorded in a computer-readable recording medium including the recording medium **206** and the CD-ROM **213** as a file in an installable format or an executable format, and may be distributed. The transmission management program may be stored in the HD **204**.

Further, because the external input apparatus **40** has a similar hardware structure as the transmission management system **50**, the duplicate descriptions may be omitted. In the case of the external input apparatus **40**, however, an external input apparatus program for controlling the external input apparatus **40** is included in the ROM **202**. Also, in this case, the external input apparatus program may be recorded in a computer-readable recording medium including the recording medium **206** and the CD-ROM **213** as a file in an installable format or an executable format, and may be distributed.

Further, because the relay apparatus **30** has a similar hardware structure as the transmission management system **50**, the duplicate descriptions may be omitted. In the case of the relay apparatus **30**, however, a relay apparatus program for controlling the relay apparatus **30** is included in the ROM **202**. Also, in this case, the relay apparatus program may be recorded in a computer-readable recording medium including the recording medium **206** and the CD-ROM **213** as a file in an installable format or an executable format, and may be distributed.

Further, because the program providing system **90** has a similar hardware structure as the transmission management system **50**, the duplicate descriptions may be omitted. In the case of the program providing system **90**, however, a program providing system program for controlling the program providing system **90** is included in the ROM **202**. Also, in this case, the program providing system program may be recorded in a computer-readable recording medium including the recording medium **206** and the CD-ROM **213** as a file in an installable format or an executable format, and may be distributed. It should be noted that the program providing system program may be stored not in the ROM **202** but in the HD **204**.

Further, because the maintenance system **100** has a similar hardware structure as the transmission management system **50**, the duplicate descriptions may be omitted. The maintenance system **100** is a computer for maintaining or managing at least one of the transmission terminal **10**, the relay apparatus **30**, the transmission management system **50**, and the program providing system **90**. For example, in the case where the maintenance system **100** is located in a country and the transmission terminal **10**, the relay apparatus **30**, the transmission management system **50** or the program providing system **90** is located out of the country, the maintenance system **100** remotely maintains or manages at least one of the transmission terminal **10**, the relay apparatus **30**, the transmission management system **50** and the program providing system **90** via the communication network **2**.

Further, the maintenance system **100** may perform management of a model number, a serial number, a sale destination, a record of maintenance and inspection, a record of failure, or the like, of at least one of the transmission terminal **10**, the relay apparatus **30**, the transmission management system **50** and the program providing system **90** without using the communication network **2**.

It should be noted that, as another example of a detachable recording medium, a computer-readable recording medium including a compact disc recordable (CD-R), a digital versatile disk (DVD), a Blu-ray disc (BD), etc., may be used for storing the programs.

<<Functional Structure>>

In the following, referring to FIGS. **4** through **12**, a functional structure according to an embodiment will be described. FIG. **4** is a functional block diagram of an information processing apparatus **20**, a relay apparatus **30** and a transmission management system **50** included in the transmission system **1** according to an embodiment. In an example shown in FIG. **4**, the information processing apparatus **20**, the relay apparatus **30** and the management **50** are connected to each other and capable of performing data communications with each other via the communication network **2**. It should be noted that the transmission terminal **10**, the external input apparatus **40**, the program providing system **90** and the maintenance system **100** shown in FIG. **1** are omitted in FIG. **4**.

FIGS. **5**A through **5**C are drawings illustrating image quality of an image data. Further, FIG. **6** is an example of a change quality management table. FIG. **7** is an example of a relay apparatus management table. FIG. **8** is an example of a terminal authentication management table. FIG. **9** is an example of a terminal management table. FIG. **10** is a destination list management table. FIG. **11** is an example of a session management table. FIG. **12** is an example of a quality management table.

<Functional Structure of Transmission Terminal>

As shown in FIG. **4**, the information processing apparatus **20** includes a transmitting and receiving unit **11**, an operation input accepting unit **12**, a login request unit **13**, an imaging unit **14***a*, an image display control unit **14***b*, a display data obtaining unit **14***c*, an audio input unit **15***a*, an audio output unit **15***b*, a delay detection unit **17**, a transparent display control unit **18**, a storing and reading processing unit **19**, a resolution obtaining unit **21***a*, a resolution determination unit **21***b*, a resolution selection unit **21***c*, and a resolution change unit **21***d*. The above units are functions or means which are realized by any of the elements shown in FIG. **2** which operate according to instructions from the CPU **101** which operates according to a program stored in the ROM **102**. Further, the transmission terminal **10** includes a memory unit **1000** including the SSD **105** as shown in FIG. **2**.

<Functional Units of Transmission Terminal>

Next, functional units of the information processing apparatus **20** will be described in detail. The transmitting and receiving unit **11** of the information processing apparatus **20** is realized by a network I/F **111** shown in FIG. **2**, and transmits and receives various data to and from the other information processing apparatus **20**, the transmission terminal **10**, the relay apparatus **30** and the transmission management system **50** via the communication network **2**. The operation input accepting unit **12** is realized by the operation button **108** and the power supply switch **109** shown in FIG. **2**, and accepts various inputs from a user. For example, when the user turns ON the power supply switch **109**, the operation input accepting unit **12** accepts an input of power supply ON, and turns on the power. Further, the operation input accepting unit **12** accepts resolution information indicating the resolution input by the user.

The login request unit **13** is realized by instructions from the CPU **101** shown in FIG. **2**, and, triggered by an operation by the user, automatically transmits to the transmission management system **50** login request information indicating a login request and a current IP address of the information processing apparatus **20** by using the transmitting and receiving unit **11** via the communication network **2**.

The imaging unit **14***a* is realized by the camera **112** and the imaging element I/F **113** shown in FIG. **2**, and generates image data representing a taken image of an object. The image display control unit **14***b* is realized by the display I/F **117** shown in FIG. **2**, performs rendering of the image data, and causes the image represented by the image data to be displayed on the display device **120**. The display data obtaining unit **14***c* obtains the image data representing the image displayed on the display device **120**. In an embodiment, data representing an image taken by the camera **112** is referred to as "image data". Further, data representing an image displayed on the display device **120**, which data is obtained by the display data obtaining unit **14***c*, is referred to as "display data". It should be noted that the image data and the display data have a format of Joint Photographic Experts Group (JPEG), Bitmap, Graphics Device Interface (GDI), or the like.

The audio input unit **15***a* is realized by the mike **114** and the audio input output I/F **116** shown in FIG. **2**, and outputs audio data of an audio signal converted from voice input by a user. The audio output unit **15***b* is realized by the speaker **115** and the audio input output I/F **116**, and converts the audio data of the audio signal into voice and outputs it.

The delay detection unit **17** is realized by instructions from the CPU **101** shown in FIG. **2**, and detects delay time (ms) of the image data or the audio data transmitted from the information processing apparatus **20** or the transmission terminal **10** via the relay apparatus **30**. Further, the storing and reading processing unit **19** is realized by the SSD **105** shown in FIG. **2**, stores various data in the storage unit **1000**, and reads the various data stored in the storage unit **1000**.

The resolution obtaining unit **21***a* obtains available resolutions of the display device **120** connected to the information processing apparatus **20**.

The resolution determination unit **21***b* determines whether the available resolutions obtained by the resolution obtaining unit **21***a* include a resolution with an aspect ratio other than the standard aspect ratio used for image data transmission. The resolution selection unit **21***c* selects from the available resolutions a resolution with an aspect ratio other than the standard aspect ratio or a resolution with the standard aspect ratio based on a result determined by the resolution determination unit **21***b*. The resolution change unit **21***d* changes the resolution of the display device **120** to the resolution indicated by the resolution information accepted by the operation input accepting unit **12**. Here, the resolution indicates a number of pixels in a predetermined length on a display screen, and includes a resolution in the vertical direction and a resolution in the horizontal direction. The transparent display control unit **18** switches ON and OFF the transparent display of a screen output onto the display device **120** by the image display control unit **14***b*. The "transparent display" means to display an image under a window (an example of a display part) transparently. In other words, image processing is performed by which a part or all of the window becomes translucent. The degree of transparency may be fixed or set by a user. The transparent display allows a user to easily recognize a first window under a second window in the case where the first window is partially overlapped with the second window, and thus, a desktop window under a window can be easily recognized. Further, the transparent display improves the design of a desktop screen.

It should be noted that in the embodiment 1, the load of the transparent display is switched in two levels, ON/OFF. However, in the case where it is possible for the information processing apparatus **20** to control the load of the transparent display in three different levels or more, the transparent display state may be switched in three levels or more.

The storage unit **1000** stores a terminal identification (ID) for identifying an information processing apparatus **20** and a password; image data and audio data; a relay apparatus ID for identifying a relay apparatus **30** for transmitting various data; an IP address of a destination terminal, etc. The terminal ID and the password are input to the information processing apparatus **20** by a user of the information processing apparatus **20**, or are stored in the information processing apparatus program **119**. Further, the information processing apparatus program **119** is stored in the storage unit **1000**. Further, the resolution information indicating the resolution of the display data output by the information processing apparatus **20** is stored in the storage unit **1000**.

Further, the terminal ID and the relay apparatus ID, which will be described later, are identification information items

such as a language, a character, a symbol, or various marks used for uniquely identifying an information processing apparatus **20** and uniquely identifying a relay apparatus **30**, respectively. Further, the terminal ID and the relay apparatus ID may be identification information in which at least two of a language, a character, a symbol, and various marks are combined. Further, in the following description, a "request source terminal" corresponds to an information processing apparatus **20** that requests a start of a video conference, and a "destination terminal" corresponds to an information processing apparatus **20** or a transmission terminal **10** as a video conference destination requested by the request source terminal **20**.

<Functional Structure of Relay Apparatus>

Next, functions or means of a relay apparatus **30** will be described. As shown in FIG. **4**, the relay apparatus **30** includes a transmitting and receiving unit **31**, a state detection unit **32**, a data quality checking unit **33**, a change quality management unit **34**, a data quality change unit **35**, and a storing and reading processing unit **39**. The above units are functions or means which are realized by any of the elements shown in FIG. **4** which operate according to instructions from CPU **201** which operates according to a program stored in the ROM **202**. Further, the terminal **30** includes a storage unit **3000** including any of a ROM **202**, a RAM **203** and a HDD **205** shown in FIG. **3**.

<<Change Quality Management Table>>

The storage unit **3000** includes a change quality management database (DB) **3001** including a change quality management table **301***t* as shown in FIG. **6**. The change quality management table **301***t* stores an IP address of an information processing apparatus **20** or a transmission terminal **10** as a relay destination of image data, associated with image quality of the image data which is relayed to the relay destination by the relay apparatus **30**.

Here, the resolution of an image of the image data handled by the transmission system **1** according to an embodiment will be described. Referring to FIGS. **5**A through **5**C, there are an image with low resolution, which serves as a base image and includes 160 pixels in the horizontal direction and 120 pixels in the vertical direction as shown in FIG. **5**A; an image with medium resolution, which includes 320 pixels in the horizontal direction and 240 pixels in the vertical direction as shown in FIG. **5**B; and an image with high resolution, which includes 640 pixels in the horizontal direction and 480 pixels in the vertical direction as shown in FIG. **5**C. In the case where the image data is relayed through a narrow band route, low quality image data only including image data with low resolution which serves to form a base image is relayed.

In the case where the image data is relayed through a relatively wide band route, medium quality image data including image data with low resolution which serves to form a base image and image data with medium resolution is relayed. Further, in the case where the image data is relayed through a very wide band route, high quality image data including image data with low resolution which serves to form a base image, image data with medium resolution, and image data with high resolution is relayed.

In the change quality management table **301***t* shown in FIG. **6**, for example, the image quality of the relayed data (quality of the image) is "high quality" in the case where a relay apparatus **30** relays image data for the transmission terminal **10***db* (refer to FIG. **1**) as a destination terminal with an IP address "1. 3. 2. 4".

<Functional Units of Relay Apparatus>

Next, functional units of the relay apparatus **30** will be described in detail. It should be noted that in the following description, when the functional units of the relay apparatus **30** are described, relations between the functional units and main elements used for realizing the functional units of the relay apparatus **30** will also be described.

The transmitting and receiving unit **31** of the relay apparatus **30** is realized by a network I/F **209** shown in FIG. **3**, and transmits and receives various data to and from the information processing apparatus **20**, the transmission terminal **10**, the other relay apparatus **30** and the transmission management system **50** via the communication network **2**. The state detection unit **32** is realized by instructions from the CPU **201** shown in FIG. **3**, and detects an operational state of the relay apparatus **30** that includes the state detection unit **32**. "ONLINE", "OFFLINE", "TALKING" and "OUT OF ORDER" are included as operational states.

The data quality checking unit **33** is realized by instructions from the CPU **201** shown in FIG. **3**, and, checks image quality of the relayed image data by, using an IP address of the destination terminal as a search key, searching the change quality management table **301***t*, and extracting image quality of the relayed image data corresponding to the IP address. The change quality management unit **34** is realized by instructions from the CPU **201** shown in FIG. **3**, and changes contents of the change quality management DB **3001** based on quality information, which will be described later, transmitted by the transmission management system **50**. For example, in the case where, when a video conference is held between an information processing apparatus **20***aa* with a terminal ID "**01***aa*" and a transmission terminal **10***db* with a terminal ID "**01***db*", a delay in receiving image data occurs at the transmission terminal **10***db* due to the start of another video conference between an external input apparatus **40***bb* and an information processing terminal **20***ca* via the communication network **2**, it is necessary for the relay apparatus **30** to change the image quality of the relayed image data from high quality to medium quality. In this case, the contents of the change quality management DB **3001** are changed so that the image quality of the image data relayed by the relay apparatus **30** is changed from high quality to medium quality based on the quality information indicating medium quality.

The data quality change unit **35** is realized by instructions from the CPU **201** shown in FIG. **3**, and changes image quality of the image data transmitted from the transmission source terminal based on the changed contents of the change quality management DB **3001**. The storing and reading processing unit **39** is realized by the HDD **205** shown in FIG. **3**, stores various data in the storage unit **3000**, and reads the various data stored in the storage unit **3000**.

<Functional Structure of Transmission Management System>

Next, functions or means of a transmission management system **50** will be described. The transmission management system **50** includes a transmitting and receiving unit **51**, a terminal authentication unit **52**, a state management unit **53**, a terminal extracting unit **54**, a terminal state obtaining unit **55**, a session management unit **57**, a quality determination unit **58**, a storing and reading processing unit **59**, and a delay time management unit **60** as shown in FIG. **4**. The above units are functions or means which are realized by any of the elements shown in FIG. **3** which operate according to instructions from the CPU **201** which operates according to a program stored in the ROM **202**. Further, the transmission

management system **50** includes a storage unit **5000** including the ROM **202**, the RAM **203** or the HDD **205** shown in FIG. **3**.

<<Relay Apparatus Management Table>>

The storage unit **5000** includes a relay apparatus management database **5001** including a relay apparatus management table **501***t* as shown in FIG. **7**. In the relay apparatus management table **501***t*, for each relay apparatus **30**, a relay apparatus ID of the relay apparatus **30** is associated with an operational state of the relay apparatus **30**; receive date and time when state information indicating the operational state is received by the transmission management system **50**; an IP address of the relay apparatus **30**; and a maximum data transmission rate (Mbps) of the relay apparatus **30**. For example, the relay apparatus management table **501***t* shown in FIG. **7** indicates that an operational state of the relay apparatus **30***a* with a relay apparatus ID "**111***a*" (refer to FIG. **1**) is "ONLINE"; receive date and time when the operational state is received by the transmission management system **50** is "Nov. 10, 2009, 13:00"; an IP address of the relay apparatus **30***a* is "1. 2. 1. 2."; and a maximum data transmission rate of the relay apparatus **30** is 100 Mbps.

<<Terminal Authentication Management Table>>

The storage unit **5000** includes a terminal authentication management DB **5002** including a terminal authentication management table **502***t* as shown in FIG. **8**. In the terminal authentication management table **502***t*, for each of the transmission terminals **10** managed by the transmission management system **50**, a terminal ID of the transmission terminal **10** is associated with a password. For example, it is illustrated in the terminal authentication management table **502***t* shown in FIG. **8**, that a terminal ID of the information processing apparatus **20***aa* is "**01***aa*", and a password is "aaaa".

<<Terminal Management Table>>

Further, the storage unit **5000** includes a terminal management DB **5003** including a terminal management table **503***t* as shown in FIG. **9**. In the terminal management table **503***t*, for each of the information processing apparatuses **20** and the transmission terminals **10**, a terminal ID is associated with an operational state of the information processing terminal **20** or the transmission terminal **10**; receive date and time when login request information (described later) is received by the transmission management system **50**; and an IP address of the information processing apparatus **20** or the transmission terminal **10**. For example, in the terminal management table **503***t* shown in FIG. **9**, it is illustrated that an operational state of the information processing apparatus **20***aa* with a terminal ID "**01***aa*" is "ONLINE"; receive date and time when login request information is received by the transmission management system **50** is "Nov. 10, 2009, 13:40"; and an IP address of the information processing apparatus **20** is "1. 2. 1. 3".

<<Destination List Management Table>>

Further, the storage unit **5000** includes a destination list management DB **5004** including a destination list management table **504***t* as shown in FIG. **10**. In the destination list management table **504***t*, a terminal ID of a request source terminal that requests a start of a video conference is associated with terminal IDs of all terminals registered as a destination terminal candidate. For example, it is illustrated in the destination list management table **504***t* shown in FIG. **10**, that destination terminal candidates to which the information processing apparatus **20***aa* with a terminal ID "**01***aa*" can transmit a video conference start request are an information processing apparatus **20***ab* with a terminal ID "**01***ab*", a transmission terminal **10***ba* with a terminal ID "**01***ba*", and a transmission terminal **10***db* with a terminal ID "**01***db*". The destination terminal candidates are updated (added or deleted) according to an addition request or a deletion request from the start request terminal to the transmission management system **50**.

<<Session Management Table>>

Further, the memory unit **5000** includes a session management DB **5005** including a session management table **505***t* as shown in FIG. **11** is included. In the session management table **505***t*, each selection session ID used for selecting a relay apparatus **30** for a session is associated with a relay apparatus ID of a relay apparatus **30**; a terminal ID of a request source terminal; a terminal ID of a destination terminal; delay time (ms); and receive date and time when delay information is received. Here, the delay time (ms) is when image data is received by the destination terminal, and receive data and time when delay information is received is when delay information indicating the delay time transmitted by the destination terminal is received by the transmission management system **50**.

For example, it is illustrated in the session management table **505***t* shown in FIG. **11** that the relay apparatus **30***a* (relay apparatus ID "**111***a*") is selected for a session established by using a selection session ID "se**1**", and relays image data and audio data between an information processing apparatus **20***aa* with a terminal ID "**01***aa*" (refer to FIG. **1**) and a transmission terminal **10***db* with a terminal ID "**01***db*". Further, it is illustrated that the delay time of the image data at the transmission terminal **10***db* is 200 ms at "14:00 in Nov. 10, 2009".

It should be noted that in the case where a video conference is held between two transmission terminals **10**, the receive date and time of the delay information may be transmitted not from the destination terminal **10** but from the request source terminal **10**, and stored in the session management table **505***t*. It should be noted that in the case where a video conference is held among three or more communication terminals, the receive date and time of the delay information transmitted from the communication terminal that receives image data and audio data may be stored in the session management table **505***t*.

<<Quality Management Table>>

Further, the storage unit **5000** includes a quality management DB **5007** including a quality management table **507***t* as shown in FIG. **12**. In the quality management table, the delay time (ms) of the image data at the start request terminal or at the destination terminal is associated with image quality of the image data (quality of the image) relayed by the relay apparatus **30**.

<Functional Units of Transmission Management System>

Next, functional units of the transmission management system **50** will be described in detail. It should be noted that in the following description, when the functional units of the transmission management system **50** are described, relations between the functional units and main elements shown in FIG. **3** used for realizing the functional units of the transmission management system **50** will also be described.

First, the transmitting and receiving unit **51** is realized by a network I/F **209** shown in FIG. **3**, and transmits and receives various data to and from the information processing apparatus **20**, the transmission terminal **10**, the relay apparatus **30** or the other systems (program providing system **90** and/or maintenance system **100**) via the communication network **2**. The terminal authentication unit **52** performs terminal authentication by searching the terminal authentication management DB **5002** of the storage unit **5000** by using as search keys a terminal ID and a password included

in login request information received via the transmitting and receiving unit **51**, and determining whether the same terminal ID and the password are stored in the terminal authentication management DB **5002**. In order to control an operational state of a login request source terminal, the state management unit **53** associates a terminal ID of the login request source terminal with an operational state of the login request source terminal; receive date and time when the login request information is received by the transmission management system **50**; and an IP address of the login request source terminal, and stores them in the terminal management table **503***t*.

The terminal extracting unit **54** extracts a terminal ID by using as a search key a terminal ID of the login request source terminal, searching the destination list management table **504***t*, and extracting a terminal ID of a destination terminal candidate that can communicate with the request source terminal. Further, the terminal extracting unit **54** extracts a terminal ID of another request source terminal for which the terminal ID of the request source terminal is registered as a destination terminal candidate by, using the terminal ID of the login request source terminal as a search key, searching the destination list management table **504***t*.

The terminal state obtaining unit **55** extracts operational states of terminal IDs extracted by the terminal extracting unit **54** by, using as search keys the terminal IDs of the destination terminal candidates extracted by the terminal extracting unit **54**, searching the terminal management table **503***t*. With the above operation, the terminal state obtaining unit **55** can obtain operational states of the destination terminal candidates which are capable of communicating with the login request source terminal. Further, the terminal state obtaining unit **55** also obtains an operational state of the login request source terminal by, using as a search key the terminal ID extracted by the terminal extracting unit **54**, searching the terminal management table **503***t*.

The session management unit **57** associates a generated selection session ID with a terminal ID of the request source terminal and a terminal ID of the destination terminal, and stores them in the session management DB **5005** (session management table **505***t* in FIG. **11**). Further, the session management unit **57** stores a relay apparatus ID of a relay apparatus **30** in the session management table **505***t*.

The quality determination unit **58** determines image quality of image data that are relayed by the relay apparatus **30** by, using the above delay time as a search key, searching the quality management table **507***t*, and extracting corresponding image quality of image data. The storing and reading processing unit **59** is realized by the HDD **205** shown in FIG. **3**, stores various data in the storage unit **5000**, and reads the various data stored in the storage unit **5000**. The delay time management unit **60** searches the terminal management table **503***t* by using an IP address of the destination terminal as a search key, extracts a corresponding terminal ID, and further, stores the delay time indicated by the delay information in a delay time field of a record in the session management table **505***t*, in which record the extracted terminal ID is included.

<Example of Screen Display>

FIG. **13** is a drawing illustrating an example of a desktop screen displayed on a display device **120**. Two windows A and B are displayed on the desktop screen. The window A is created and displayed by any application, and the window B is created and displayed by the image display control unit **14***b* of the information processing apparatus program **119**. It should be noted that the information processing apparatus program **119** treats the entire desktop also as a window. In the following, a window created by an application is referred to as "application window", the entire desktop is referred to as "desktop window", and when they are not distinguished, simply referred to as "window".

A window displayed on the display device **12** by the information processing apparatus **20** is controlled by the OS. The information processing apparatus program **119** can obtain identification information (e.g., a handle in Windows (registered trademark)) of a window by requesting the OS to provide the identification information of the window currently displayed by an API. If the identification information of the window is obtained, the name of the title bar can be displayed. It should be noted that although the windows A and B are separated in the figure, the window whose display data is obtained and the window of the information processing apparatus program **119** may be overlapped.

Therefore, the information processing apparatus program **119** can obtain display data of any window selected by a user by identifying the window by, for example, a handle. The window selected by the user is referred to as a "selected window" in the following description.

FIG. **14** is a drawing illustrating an example of a login screen displayed by the information processing apparatus program **119**. When the information processing apparatus program **119** is started, a login screen shown in FIG. **14** is displayed (may be displayed independently or may displayed in the window B in FIG. **13**). The login screen includes a login ID column **503**, a password column **504** and a login button **505**. When a user inputs a terminal ID in the login ID column **503** and a password in the password column **504**, and presses the login button **505**, the login operation is accepted by the operation input accepting unit **12**. With the above operation, the login request unit **13** transmits a login request to the transmission management system **50**.

FIG. **15** is a drawing illustrating an example of an application window (main screen) displayed by the information processing apparatus program **119**. The application window mainly has three areas including a top bar **510**, a main display part **520**, and a bottom bar **530**. In the top bar **510**, a name **511** of the information processing apparatus program **119**, elapsed time from the start of communications between the information processing apparatus program **119** and the destination terminal, and a communication speed **513** are displayed.

Further, in the bottom bar **530**, a list button **531**, a view button **532**, a sharing button **533**, a camera button **534**, a mike button **535**, a volume button **536**, and a connection/disconnection button **537** are displayed. The list button **531** is used for displaying a destination list in step S**41** in FIG. **22** which will be described later. The view button **532** is used for displaying selectable display formats of the main display part **520**. The user can choose to display the display data and one or more (as many as a number of destination terminals) image data items, display only the display data, or display only image data by pressing the view button **532** and selecting a display format. The sharing button **533** is used for displaying a list of windows with which display data can be shared, and starting sharing display data with a selected window. The camera button **534** is used for switching ON/OFF taking a picture by the camera. The mike button **535** is used for switching ON/OFF collecting sound by the mike. The volume button **536** is used for adjusting volume output from the speaker. The connection/disconnection button **537** is used for starting a video conference (login) and for ending the video conference (logoff). The connection/

disconnection button **538** is displayed as "connection" before login, and displayed as "disconnection" after login.

FIG. **15** shows a state in which the sharing button **533** is pressed. As a result, a list of display data sharing available windows is displayed. In other words, "Geegle Internet Browser" and "desktop" are displayed. The application window of the "Geegle Internet Browser" corresponds to the window A in FIG. **13**. Therefore, an icon **538** indicating the sharing is displayed at the right end of the "Geegle Internet Browser". In the case where the user wants to share the display data of another window ("desktop" in the figure), the user selects "desktop".

Further, a menu "sharing end", used for indicating that the display data is already being shared and used for ending the sharing, is displayed. The user selects the menu "sharing end" in the case where the user ends the sharing.

In the main display part **520**, the display data **521** of the window A ("Geegle Internet Browser"), of which display data is currently shared, is displayed. Further, the display data **521** is transmitted to the transmission terminal **10***db* as a destination terminal, and is shared with the transmission terminal **10***db*.

FIG. **16** is a drawing of an example illustrating display data sharing. The information processing apparatus **20***aa* and the transmission terminal **10***db* are connected via the relay apparatus **30**. The external input apparatus **40***db* and the display device **120***db* are connected to the transmission terminal **10***db*.

The window A and the window B are displayed on the display device **120***aa* of the information processing apparatus **20***aa*. The window B is an application window created by the information processing apparatus program **119**. In the case where a user selects the window A by using the sharing button **533**, the display data obtaining unit **14***c* obtains display data of the window A and the transmitting and receiving unit **11** transmits the display data to the transmission terminal **10***db*. In the case where the user selects the "desktop" by using the sharing button **533**, the transmitting and receiving unit **11** transmits data of the desktop window to the transmission terminal **10***db*.

On the screen I of the transmission terminal **10***db*, the display data of the desktop window, image data taken by the camera **112** of the information processing apparatus **20***aa*, and image data taken by the camera **112** of the transmission terminal **10***db* are displayed. In other words, the display device **120***db* is divided into three areas, and the display data and two image data items are displayed.

On the screen II of the transmission terminal **10***db*, image data taken by the camera **112** of the information processing apparatus **20***aa*, and image data taken by the camera **112** of the transmission terminal **10***db* are displayed.

<Combining Icon Image (Mouse)>

When the display data obtaining unit **14***c* obtains the selected window, an image of a mouse cursor may not be obtained depending on an information processing apparatus **20**. Therefore, it is preferable that, in the case where the display data obtaining unit **14***c* obtains the display data of the selected window in which a mouse cursor is included, the mouse cursor be combined with the display data.

As shown in FIG. **4**, the display data obtaining unit **14***c* includes an instruction information obtaining unit **141** and a display data creating unit **142**. The instruction information obtaining unit **141** obtains instruction information such as position information of a mouse cursor, an icon image **17***g* (FIG. **17**) of the mouse cursor, etc.

The instruction information includes a coordinate data **17***h* (FIG. **17**) of the mouse cursor on the screen, or includes the coordinate data **17***h* of the mouse cursor on the screen and the icon image **17***g*. The coordinate data **17***h* of the mouse cursor can be obtained by a request to the OS by using an API. The icon image **17***g* of the mouse cursor may be obtained from the OS, or the icon image **17***g* of a known mouse cursor may be provided beforehand as image data.

The display data creating unit **142** combines the icon image **17***g* with the display data. The information processing apparatus **20** transmits the combined display data to the transmission terminal **10***db*, etc. Therefore, users can share the position information the mouse cursor specifies in the display data on the screen.

A method of combining the icon image **17***g* of the mouse cursor in the case where it is combined with the display data of the desktop window is different from a method in the case where it is combined with the display data of the application window.

In the Case of Combining with the Display Data of the Desktop Window

FIG. **17** is a drawing of an example illustrating combining the icon image **17***g* of the mouse cursor with display data **17***d*. The display data **17***d* in FIG. **17** corresponds to an entire screen displayed on the display device **120***aa* by the information processing apparatus **20***aa*. The mouse cursor can move around the entire desktop screen.

The instruction information obtaining unit **141** obtains the icon image **17***g* of the mouse cursor and the coordinate data **17***h* of the mouse cursor. The coordinate data **17***h* is represented by using a Cartesian coordinate system, and is a coordinate set indicating in pixel units a two-dimensional position of the mouse cursor with respect to the top left corner as an origin.

Therefore, it is possible for the display data creating unit **142** to combine the mouse cursor with the display data **17***d* by, for example, placing the tip portion of the mouse cursor at a position of the display data **17***d* indicated by the coordinate data **17***h*. It should be noted that to combine the mouse cursor means to place the icon image **17***g* of the mouse cursor in the display data **17***d* (to replace the pixel values of the overlapped pixels) to obtain combined image data.

In the Case of Combining with the Display Data of an Application Window

FIG. **18** is a drawing of an example illustrating combining the icon image **17***g* of the mouse cursor with display data. Coordinates (X, Y) of the mouse cursor have a top left corner of the desktop screen as an origin. However, the selected window is merely a partial area of the desktop screen. Therefore, if the icon image **17***g* is combined with display data **17***d* of a selected window by using the coordinates (X, Y), then the icon image **17***g* is placed at the coordinates (X, Y) with respect to the top left corner of the selected window, the coordinates of the top left corner of the selected window being (X', Y'), and thus, the position of the icon image **17***g* in the display data **17***d* is different from an intended position.

Therefore, the instruction information obtaining unit **141** adjusts the coordinate data **17***h* of the mouse cursor as shown below in the case where the selected window is not the desktop window but the application window.

$$X=X-X'$$

$$Y=Y-Y'$$

With the above operation, relative position between the display data **17***d* and the icon data **17***g* can be maintained and the icon image **17***g* can be combined with the display data **17***d*.

FIG. **19** is a flowchart of an example of a procedure of the display data obtaining unit **14***c* for combining the icon image **17***g* of the mouse cursor with the display data. A process shown in FIG. **19** is performed in step S**77-2** in a process shown in FIG. **23**.

The instruction information obtaining unit **141** obtains the coordinate data **17***h* of the mouse cursor (S**77-21**). In the case of the display data of the desktop window, the icon image **17***g* is combined with the display data.

The instruction information obtaining unit **141** determines whether the coordinate data **17***h* obtained in step S**77-21** is included in the application window (S**77-22**).

In the case where the coordinate data **17***h* is not included in the application window (NO in S**77-22**), it is not necessary to combine the icon image **17***g* with the display data. Therefore, the display data creating unit **142** ends its process without combining the icon image **17***g* of the mouse cursor with the display data.

In the case where the coordinate data **17***h* is included in the application window (YES in S**77-22**), the instruction information obtaining unit **141** obtains the icon image **17***g* of the mouse cursor (S**77-23**).

Next, the display data creating unit **142** combines the icon image **17***g* obtained in step S**77-23** with the display data of the selected window and ends its process (S**77-24**). In other words, the display data creating unit **142** refers to the coordinates (X, Y) of the tip portion of the mouse cursor and the coordinates (X', Y') of the left top corner of the active area **18***r*. Further, the display data creating unit **142** combines the icon image **17***g* of the mouse cursor with the display data in which only the image of the active area **18***r* is included, by placing the icon image **17***g* at a position ((X-X'), (Y-Y')) having the top left corner of the active area **18***r* as an origin.

With the above operation, the mouse cursor can be displayed with the display data. It should be noted that it is assumed that an application window is selected in S**77-22** in FIG. **19**. However, the combining process in the case where an application window is selected can be always applied, and in the case where the desktop window is selected, it can be assumed that X'=0 and Y'=0.

<<Process and Operation of Embodiment>>

Next, referring to FIG. **20** through FIG. **24**, processes and operations performed in the transmission system **1** according to an embodiment will be described. FIG. **20** is a sequence diagram illustrating an example of a process for controlling status information indicating operational states of relay apparatuses **30** transmitted from the relay apparatuses **30** to the transmission management system **50**. FIG. **21** is a sequence diagram illustrating an example of a preparation stage process for starting communications between the information processing apparatus **20** and another information processing apparatus **20** or a transmission terminal **10**. FIG. **22** is a sequence diagram illustrating an example of a process of a transmission terminal for establishing a session. FIG. **23** is a sequence diagram illustrating an example of a process for causing the other information processing apparatus **20** or the transmission terminal **10** as a destination of a conference to display the display data displayed by the information processing apparatus **20**. FIG. **24** is a flowchart of an example of a procedure for obtaining display data.

First, referring to FIG. **20**, a process for controlling status information indicating operational states of relay apparatuses **30** transmitted from the relay apparatuses **30** to the transmission management system **50** will be described. In each of the relay apparatuses **30** (**30***a* through **30***d*), the state detection unit **32** periodically detects an operational state of its relay apparatus **30** (S**1-1** through S**1-4**). Further, in order for the transmission management system **50** to control operational states of the relay apparatuses **30** in real time, the transmitting and receiving unit **31** of each relay apparatus **30** periodically transmits status information of its relay apparatus **30** to the transmission management system **50** via the communication network **2** (steps S**2-1** through S**2-4**). The status information includes a relay apparatus ID of the relay apparatus **30** and the operational state of the relay apparatus **30** corresponding to the relay apparatus ID detected by the state detecting unit **32**. It should be noted that it is assumed in the following embodiment that the relay apparatuses **30***a*, **30***b* and **30***d* are in "ONLINE" state and operating normally, and the relay apparatus **30***c* is operating but is in "OFFLINE" state because there is some problem in a program used for the relay apparatus **30***c* to perform its operation.

Next, the transmission management system **50** receives the status information transmitted from the relay apparatuses **30***a* through **30***d* via the transmitting and receiving unit **51**, and stores the status information associated with a relay apparatus ID in the relay apparatus management DB **5001** (relay apparatus management table **501***t* in FIG. **7**) of the storage unit **5000** via the storing and reading processing unit **59** (steps S**3-1** through S**3-4**). With the above operation, for each relay apparatus ID, any one of operational states "ONLINE", "OFFLINE" and "OUT OF ORDER" is stored in the relay apparatus management table **501***t*. At this time, for each relay apparatus ID, receive date and time when the status information is received by the transmission management system **50** is also stored. It should be noted that in the case where status information is not transmitted from a relay apparatus **30**, a field of an operational state and a field of receive date and time in the record of the relay apparatus management table **501***t* may be blank or the fields may maintain the previous operational state and the previous receive date and time.

Next, referring to FIG. **21**, a preparation stage process before starting communications between the information processing apparatus **20***aa* and the transmission terminals **10***ba* and **10***db* will be described. First, when a user starts the information processing apparatus program **119**, a login screen shown in FIG. **14** is displayed. The user inputs a terminal ID and a password, and presses the login button **505** (step S**21**).

Next, triggered by pressing of the login button **505**, the login request unit **13** automatically transmits from the transmitting and receiving unit **11** login request information indicating a login request to the transmission management system **50** via the communication network **2** (step S**22**). The login request information includes a terminal ID used for identifying the information processing apparatus **20***aa* as a request source and a password. The terminal ID and the password are read from the storage unit **100** via the storing and reading processing unit **19** and transmitted to the transmitting and receiving unit **11**. It should be noted that when the login request information is transmitted from the information processing apparatus **20***aa* to the transmission management system **50** as the receiver, the transmission management system **50** can obtain an IP address of the sender, namely the information processing apparatus **20***aa*.

Next, the terminal authentication unit **52** of the transmission management system **50** performs terminal authentica-

tion by searching the terminal authentication management DB **5002** (terminal authentication management table **502***t* in FIG. **8**) of the storage unit **5000** by using as search keys the terminal ID and the password included in the login request information received via the transmitting and receiving unit **51**, and determining whether the same terminal ID and the password are stored in the terminal authentication management DB **5002** (step S**23**). In the case where it is determined that the same terminal ID and the password are stored in the terminal authentication management DB **5002** and that the login request is from an information processing apparatus **20** or a transmission terminal **10** that has a proper use right, the status management unit **53** associates the terminal ID of the information processing apparatus **20** with the operational state, receive date and time when the login request information is received, and an IP address of the information processing apparatus **20***aa*, and stores them in the terminal management DB **5003** (terminal management table **503***t* in FIG. **9**) (step S**24**). With the above operation, the operational state "ONLINE", receive date and time "2009. 11. 10. 13:40" and a terminal IP address "1. 2. 1. 3" are associated with the terminal ID "**01***aa*" of the information processing apparatus **20***aa* and stored in the terminal management table **503***t* (FIG. **9**).

Next, the transmitting and receiving unit **51** of the transmission management system **50** transmits authentication result information indicating the authentication result obtained by the terminal authentication unit **52** to the information processing apparatus **20***aa* as a request source of the login request via the communication network **2** (step S**25**). The description continues for the case where it is determined by the terminal authentication unit **52** that the terminal has a proper use right.

The terminal extracting unit **54** of the transmission management system **50** extracts a terminal ID by, using as a search key a terminal ID "**01***aa*" of the information processing apparatus **20***aa* requesting login, searching the destination list management table **504***t*, and reading a terminal ID of a destination terminal candidate that can communicate with the information processing apparatus **20***aa* (step S**26**). Here, terminal IDs "**01***ab*", "**01***ba*" and "**01***db*" of the information processing apparatus **20***ab*, the transmission terminal **10***ba* and the transmission terminal **10***db* which can be a destination terminal for the information processing apparatus **20***aa* with a terminal ID "**01***aa*" are extracted.

Next, the terminal state obtaining unit **55** obtains operational states of the destination terminals (the information processing apparatus **20***ab*, the transmission terminal **10***ba*, and the transmission terminal **10***db*) by, using as search keys the terminal IDs ("**01***ab*", "**01***ba*", "**01***db*") of the destination terminal candidates extracted by the terminal extracting unit **54**, searching the terminal management table **503***t*, and reading operational states ("OFFLINE", "ONLINE", "ONLINE") of the terminal IDs extracted by the terminal extracting unit **54** (step S**27**).

Next, the transmitting and receiving unit **51** transmits destination state information including the terminal IDs ("**01***ab*", "**01***ba*", "**01***db*") used as search keys in step S**27** and the operational states ("OFFLINE", "ONLINE", "ONLINE") of the corresponding terminals (the information processing apparatus **20***ab*, the transmission terminal **10***ba*, and the transmission terminal **10***db*) via the communication network **2** (step S**28**). With the above operation, the information processing apparatus **20***aa* can obtain the current operational states ("OFFLINE", "ONLINE", "ONLINE") of the destination terminal candidates, the information processing apparatus **20***ab*, the transmission terminal **10***ba*, and the transmission terminal **10***db*, that can communicate with the information processing apparatus **20***aa*.

Further, the terminal extracting unit **54** of the transmission management system **50** searches the destination list management table **504***t* by using as a search key a terminal ID "**01***aa*" of the information processing apparatus **20***aa* requesting login, and extracts a terminal ID of another request source terminal for which the terminal ID "**01***aa*" of the information processing apparatus **20***aa* is registered as a destination terminal candidate (step S**29**). In the destination list management table **504***t* shown in FIG. **10**, extracted terminal IDs of the other request source terminals are "**01***ab*", "**01***ba*" and "**01***db*".

Next, the terminal state obtaining unit **55** of the transmission management system **50** searches the terminal management table **503***t* by using as a search key a terminal ID "**01***aa*" of the information processing apparatus **20***aa* requesting login, and obtains the operational state of the information processing apparatus **20***aa* (step S**30**).

Next, the transmitting and receiving unit **51** transmits destination state information including a terminal ID "**01***aa*" and an operational state "ONLINE" of the information processing apparatus **20***aa* obtained in step S**30** to the request source terminals (the transmission terminals **10***ba* and **10***db*) whose operational states in the terminal management table **503***t* are "ONLINE" of the request source terminals of the terminal IDs ("**01***ab*", "**01***ba*", and "**01***db*") extracted in step S**29** (steps S**31-1**, S**31-2**). It should be noted that when the transmitting and receiving unit **51** transmits the destination state information to the request source terminals (transmission terminals **10***ba* and **10***db*), the transmitting and receiving unit **51** refers to IP addresses of the terminals stored in the terminal management table **503***t* (FIG. **9**) based on the terminal IDs ("**01***ba*" and "**01***db*"). With the above operation, the terminal ID "**01***aa*" and the operational state "ONLINE" of the information processing apparatus **20***aa* requesting login can be transmitted to other destination terminals (the transmission terminals **10***db* and **10***ba*) that can communicate with the information processing apparatus **20***aa* as a destination.

It should be noted that in another transmission terminal **10**, when a user turns ON a power supply switch **109** (step S**21**), a power ON operation is accepted by the operation input accepting unit **12**, and processes similar to steps S**22** through S**31-1**, **31-2** are performed, whose description will be omitted.

Next, referring to FIG. **22**, a process for establishing a session between an information processing apparatus **20** and another information processing apparatus **20** or a transmission terminal **10** will be described. In an embodiment, the information processing apparatus **20***aa* can communicate with at least one of the transmission terminals **10***ba* and **10***db*, which is a transmission terminal **10** as a destination candidate and whose operational state is "ONLINE". In the following description, it is assumed that the user of the information processing apparatus **20***aa* chooses to start communications with the transmission terminal **10***db* as a destination terminal.

First, when the user presses the operation button **108** to select the transmission terminal **10***db*, the operation input accepting unit **12** of the information processing apparatus **20***aa* receives an input selecting the transmission terminal **10***db* as a destination (step S**41**). Next, the transmitting and receiving unit **11** of the information processing apparatus **20** transmits start request information indicating a communication start request and including a terminal ID "**01***aa*" of the information processing apparatus **20***aa* as a request source

terminal and a terminal ID "**01***db*" of the transmission terminal **10***db* as a destination terminal (step S**42**). With the above operation, the transmitting and receiving unit **51** of the transmission management system **50** receives the start request information and an IP address "1. 2. 1. 3" of the information processing apparatus **20***aa* as a request source terminal. Further, based on an terminal ID "**01***aa*" of the information processing apparatus **20***aa* as a request source terminal and a terminal ID "**01***db*" of the transmission terminal **10***db* as a destination terminal included in the start request information, the state management unit **53** changes the fields of operational states of records including the terminal ID "**01***aa*" and the terminal ID "**01***db*" in the terminal management table **503***t* of the terminal management DB **5003** into "COMMUNICATING" (step S**43**). In a state described above, the information processing apparatus **20***aa* and the transmission terminal **10***db* have not started a communication (call) yet, but are already in a communicating state. If another transmission terminal **10** tries to communicate with the information processing apparatus **20***aa* or the transmission terminal **10***db*, an audio message or a display message is output indicating that the information processing apparatus **20***aa* or the transmission terminal **10***db* is in a communicating state.

The transmission management system **50** generates a selection session ID used for selecting a relay apparatus **30** (step S**44**). Further, the session management unit **57** associates the selection session ID "se**1**" generated in step S**44** with a terminal ID "**01***aa*" of the information processing apparatus **20***aa* as a request source terminal and a terminal ID "**01***db*" of the transmission terminal **10***db* as a destination terminal, and stores them in the session management table **505***t* of the storage unit **5000** (step S**45**).

After this, the transmission management system **50** narrows down a final (actual) relay apparatus **30** for relaying communications between the information processing apparatus **20***aa* and the transmission terminal **10***db* based on the relay apparatus management DB **5001** and the terminal management DB **5003**, the details of which are omitted.

Next, the session management unit **57** of the transmission management system **50** stores a relay apparatus ID "**111***a*" of the relay apparatus **30***a* selected as the final (actual) relay apparatus **30** in a field of the relay apparatus ID of a record of the session management table **505***t* of the session management DB **5005** in which record the selection session ID "se**1**" is included (step S**67-1**). The transmitting and receiving unit **51** transmits the relay apparatus ID "**111***a*" and the IP address "1. 3. 2. 4" of the transmission terminal **10***db* to the information processing apparatus **20***aa* (step S**67-21**). It should be noted that the transmitting and receiving unit **51** of the transmission management system **50** transmits relay start request information indicating a relay start to the relay apparatus **30***a* via the communication network **2** (not shown). In the relay start request information, IP addresses ("1. 2. 1. 3", "1. 3. 2. 4") of the information processing apparatus **20***aa* and the transmission terminal **10***db* that are relayed are included. With the above operation, the relay apparatus **30***a* establishes a session for communicating image data and audio data with three resolutions (low resolution, medium resolution and high resolution) between the information processing apparatus **20***aa* and the transmission terminal **10***db* (step S**69**). As a result, the information processing apparatus **20***aa* and the transmission terminal **10***db* can start a video conference. It should be noted that image data with three resolutions is just an example. The number of resolutions may be greater or less than 3.

It should be noted that the transmission terminals **10** transmit and receive image data by using a video coding standard including H. 264 (H. 264/AVC, MPEG-4 part 10, MPEG4 AVC), expanded standard H. 264/SVC, MPEG-2, or the like.

Next, referring to FIG. **23**, a process will be described in which, after the relay apparatus **30** is selected, display data representing an image displayed on the display device **120** of the information processing apparatus **20** is transmitted to the other information processing apparatus **20** or the other transmission terminal **10** and displayed on the display device **120** of the other information processing apparatus **20** or the other transmission terminal **10**. Here, an example will be described in which information displayed by the information processing apparatus **20***aa* is displayed by the transmission terminal **10***db* as a destination terminal.

When the relay apparatus **30** is selected, the relay apparatus ID "**111***a*" and an IP address "1. 3. 2. 4" of the transmission terminal **10***db* transmitted by the transmission management system **50** in step S**67-21** are received by the transmitting and receiving unit **11** of the information processing apparatus **20***aa*. Further, the received relay apparatus ID "**111***a*" and the IP address "1. 3. 2. 4" are stored in the storage unit **1000** by the storing and reading processing unit (step S**67-22**).

Next, the storing and reading processing unit **19** of the information processing apparatus **20***aa* reads the relay apparatus ID "**111***a*" and the IP address "1. 3. 2. 4" of the destination transmission terminal **10***db* stored in the storage unit **1000** (step S**77**).

The display data obtaining unit **14***c* obtains display data of a screen displayed on the display device **120** (step S**77-2**). A process of step S**77-2** will be described later.

Further, the transmitting and receiving unit **11** transmits resolution-converted display data and the IP address "1. 3. 2. 4" of the destination transmission terminal **10***db* to a relay apparatus **30** indicated by the relay apparatus ID "**111***a*" read in step S**77** (step S**78**).

When the relay apparatus **30** receives the display data transmitted by the information processing apparatus **20***aa* in step S**78**, image quality of the display data is changed based on the IP address "1. 3. 2. 4" of the destination transmission terminal **10***db* (step S**79**).

The relay apparatus **30** transmits the display data to the transmission terminal **10***db* (step S**80**).

When the transmitting and receiving unit **11** of the transmission terminal **10***db* receives the display data transmitted by the relay apparatus **30**, the image display control unit **14***b* displays an image represented by the received display data on the display device **120***db* (step S**81**).

FIG. **24** is a flowchart of an example of a procedure for obtaining display data in step S**77-2** in FIG. **23**. The procedure shown in FIG. **24** starts after the end of step S**77** in FIG. **23**.

First, the operation input accepting unit **12** determines whether display data sharing is started by a user (S**10**). The start of the display data sharing is detected when the sharing button **533** is pressed to select a window.

In the case where the operation input accepting unit **12** accepts the start of the display data sharing (YES in S**10**), the transparent display control unit **18** stores a current display state (S**20**). The display state is either a transparent display ON state or a transparent display OFF state. By storing the display state, the display state can be returned to the original display state after the display data sharing is ended.

The transparent display control unit **18** refers to the stored display state, and if the transparent display is ON, then turns

it OFF (S30). In other words, if the transparent display is ON, the display state is temporarily switched to a non-transparent display state. The switching method can be realized by, for example, having an application program interface (API) of desktop window manager (DWM) used by the transparent display control unit **18** in the case where the OS is Windows (registered trademark). The transparent display state can be switched from OFF to ON in a similar way.

It should be noted that Windows (registered trademark) is used as the OS in an embodiment. The transparent display state can also be switched from ON to OFF when the OS is Mac OS (registered trademark). Further, the load is increased by the transparent display in a similar way in iOS (registered trademark) or in Android (registered trademark). The transparent display state can be switched from ON to OFF in these OSs.

The display load for displaying a screen is higher in the transparent display state (an example of claimed display state with a high load) than in the non-transparent display state (an example of claimed display state with a low load). Therefore, if the audio data and the image data are obtained and the display data sharing is started while the transparent display state is maintained by the information processing apparatus **20**, then there may be a case in which an OS's process for displaying a screen on the display device **120** has a delay and the screen may flicker. In the embodiment 1, the screen display processing load can be reduced by turning OFF the transparent display state during the display data sharing, and the decreased screen image quality such as a flickering screen can be avoided.

Next, the display data obtaining unit **14***c* obtains the display data of the selected window selected by the user (S40).

Next, the operation input accepting unit **12** determines whether display data sharing is ended by a user (S50). The operation input accepting unit **12** determines whether "END SHARING" is selected from a list displayed when the sharing button **533** is pressed. In the case where "END SHARING" is not selected (NO in S50), the process proceeds to step S78 in FIG. **23** and the display data is transmitted. Afterwards, the process returns to step S40.

In the case where "END SHARING" is selected (YES in S50), the transparent display control unit **18** refers to the stored display state and the display state is returned to the stored display state (S60).

It should be noted that the display state may not be returned to the original state, and the transparent display OFF state may be maintained after the display data sharing is ended. The flickering screen can be avoided when the transparent display OFF state is maintained.

It should be noted that in the case where the transparent display state is switched OFF in step S30, the user may feel something is wrong because the display state changes from the transparent display state to the non-transparent display state. Therefore, it may be preferable that in the case where the transparent display state is switched OFF, it be reported that the transparent display state is switched OFF.

FIG. **25** is a drawing illustrating an example of a message which is displayed when transparent display is switched OFF in step S30. The transparent display control unit **18** displays a predefined message when the transparent display is switched OFF. It should be noted that the message may be displayed before or after the transparent display is switched OFF.

In FIG. **25**, a message "Color scheme of screen is changed. Operations of the following program caused the color scheme of screen of Windows (registered trademark) to temporarily change to Windows (registered trademark) basic." is displayed.

The user can use the information processing apparatus **20** almost without feeling something is wrong because the user understands why the transparent display state is changed. The message disappears when the user presses an OK button **550**.

Further, as shown in FIG. **26**, the message may be displayed as a balloon display in the task bar. FIG. **26** is a drawing illustrating another example of a message which is displayed when transparent display is switched OFF. In FIG. **26**, the message is displayed as a balloon display when transparent display is switched OFF. The message displayed as a balloon display may disappear when the user selects a closing button **540**, or the message may disappear without user operation when predetermined time elapses, which improves the operability.

As described above, an information processing apparatus **20** according to the embodiment 1 can reduce occurrence of a flickering screen by switching OFF the transparent display in a state where the load is increased as a result of sharing display data in addition to transmitting and receiving image data and audio data. Further, it is not necessary for a user to turn ON the transparent display because the transparent display is returned to ON without user operation, which improves the operability. Further, a message is displayed when the transparent display is switched OFF, which reduces the user's feeling that something is wrong.

Embodiment 2

In the embodiment 1, the information processing apparatus **20** switches OFF the transparent display in the case where the display data is shared, without distinguishing between an application window and a desktop window.

It should be noted, however, that the desktop window is not moved by user operation while the application window can be moved to any position by user operation. Therefore, the OS monitors a rewrite timing of the application window. As a result, the load for generating the display data is greater in the case where the display data of the application window is generated than in the case where the display data of the desktop window is generated.

Therefore, in the case where the display data of the desktop window (an example of claimed image data of an image of a full screen of a display apparatus) is shared, there may be a case where it is not necessary to switch OFF the transparent display. The user can see a window behind or operate a good design screen by maintaining the transparent display ON.

Therefore, an information processing apparatus **20** according to an embodiment 2 will be described, which apparatus **20** switches OFF the transparent display only in the case where the display data of an application window is shared.

It should be noted that the same elements in the embodiment 2 as the embodiment 1 perform the same functions as the embodiment 1. Therefore, only the main elements in the embodiment 2 may be described.

FIG. **27** is a flowchart of an example of a procedure for obtaining display data in step S77-2 in FIG. **23**. Steps S10 through S40 are the same as the embodiment 1.

When display data of a selected window is obtained in step S40, the operation input accepting unit **12** determines whether the selected window is changed (S41). In other words, the operation input accepting unit **12** determines

whether another window different from the current data sharing window is selected from a list of windows (except for "END SHARING") displayed as a result of pressing the sharing button **533**.

In the case where the selected window is not changed (NO in S**41**), the process proceeds to step S**50** and the remaining process will be the same as in FIG. **24**.

In the case where the selected window is changed (YES in S**41**), the transparent display control unit **18** determines whether the selected window is changed to the desktop window (S**42**).

In the case where the desktop window is selected (YES in S**42**), the processing load of generating display data is less than the case where the application window is selected. Therefore, the transparent display control unit **18** refers to the stored display state and, even when the transparent display is ON, keeps the transparent display ON (S**43**).

In the case where the desktop window is not selected (NO in S**42**), the processing load of generating display data is greater than the case where the desktop window is selected. Therefore, the transparent display control unit **18** refers to the stored display state and, when the transparent display is ON, switches OFF the transparent display (S**44**).

Next, the process proceeds to step S**45**, and the display data obtaining unit **14***c* obtains display data of the changed selected window (S**45**).

The remaining process will be the same as the embodiment 1. In other words, the operation input accepting unit **12** determines whether the display data sharing is ended by a user (S**50**). The operation input accepting unit **12** accepts a sharing end operation when "END SHARING" is selected from a list which will be described later. In the case where an operation of selecting "END SHARING" is not detected (NO in S**50**), the process proceeds to step S**78** in FIG. **23** and the display data is transmitted. Afterwards, the process returns to step S**40**.

In the case where an operation of selecting "END SHARING" is detected (YES in S**50**), the transparent display control unit **18** refers to the stored display state and the display state is returned to the stored display state (S**60**).

With the above operation, similar to the embodiment 1, the flickering screen can be reduced. Further, in the case where the display state is the transparent display state, the display state is switched to the non-transparent display state only when the selected window is not the desktop window, and thus, compared with the embodiment 1, it is less likely that the user feels something is wrong due to the change of display state.

Embodiment 3

There is a case where an application window is moved out of the desktop area when the application window is moved by a user. In this case, for example, it is necessary for the OS to perform a further process for specifying the display area of the application window, and thus, the display processing load is greater than the case where the application window is displayed within the desktop area. As a result, the load for generating the display data is greater in the case where the display data of the application window is generated, a part of the application window being out of the desktop window, than in the case where the display data of the application window is generated, the application window being within the desktop window, or the display data of the desktop window is generated.

Therefore, in the case where the application window is not out of the desktop area, it may not be necessary to switch OFF the transparent display. The user can see a window behind or operate a good design screen by maintaining the transparent display ON.

Therefore, an information processing apparatus **20** according to an embodiment 3 will be described, which apparatus **20** switches OFF the transparent display only in the case where the display data of an application window is obtained, a part of the application window being out of the desktop area.

It should be noted that the same elements in the embodiment 3 as the embodiment 1 perform the same functions as the embodiment 1. Therefore, only the main elements in the embodiment 3 may be described.

FIG. **28** is a flowchart of an example of a procedure for obtaining display data in step S**77-2** in FIG. **23**. Steps S**10** through S**40** are the same as the embodiment 1.

After storing the display state in step S**20**, the transparent display control unit **18** determines whether a part of the selected window is out of the desktop area **9***d* (FIG. **29**) (S**21**). For example, it is determined that a part of the selected window is out of the desktop area **9***d* when the following condition is met, and it is determined that a part of the selected window is within the desktop area **9***d* in the case where the condition is not met.

FIG. **29** is a drawing of an example illustrating a coordinate system used for determining whether a part of the application window is out of the desktop area **9***d*. The origin (0, 0) is set at the top left corner. (X, Y) is a coordinate set of the bottom right corner of the desktop area **9***d*. (x1, y1) is a coordinate set of the top left corner of the application window **9***a*. (x2, y2) is a coordinate set of the bottom right corner of the application window **9***a*.

As a result, the condition that a part of the application window **9***a* is out of the desktop area **9***d* will be as follows.

$x1<0$ or $y1<0$ or $x2>X$ or $y2>Y$

Returning to FIG. **28**, in the case where a part of the selected application window **9***a* is not out of the desktop area **9***d* (NO in S**21**), it is determined that the processing load of generating the display data is not high, and the transparent display control unit **18** refers to the stored display state, and, when the transparent display is ON, maintain the transparent display ON (S**22**).

In the case where a part of the selected application window **9***a* is out of the desktop area **9***d* (YES in S**21**), it is determined that the processing load of generating the display data is high, and the transparent display control unit **18** refers to the stored display state, and, when the transparent display is ON, temporarily switches OFF the transparent display (S**30**).

Next, the display data obtaining unit **14***c* obtains the display data of the selected window (S**40**). Further, the operation input accepting unit **12** determines whether the selected window is changed (S**41**). In the case where the selected window is not changed (NO in S**41**), the process proceeds to step S**50** and the remaining process will be the same as in FIG. **24**.

In the case where the selected window is changed (YES in S**41**), the transparent display control unit **18** determines whether the desktop window is selected as the selected window (S**42**). In the case where the desktop window is selected (YES in S**42**), it is determined that the processing load of generating display data is not high, and the display data obtaining unit **14***c* obtains the display data of the changed selected window (S**45**).

In the case where the desktop window is not selected (NO in S**42**), the transparent display control unit **18** determines whether a part of the selected window is out of the desktop

area **9***d* (S**42-2**). Therefore, similar to step S**21**, in the case where a part of the selected application window **9***a* is not out of the desktop area **9***d* (NO in S**42-2**), it is determined that the processing load of generating the display data is not high, and the transparent display control unit **18** refers to the stored display state, and, when the transparent display is ON, maintain the transparent display ON (S**43**).

In the case where a part of the selected application window **9***a* is out of the desktop area **9***d* (YES in S**42-2**), it is determined that the processing load of generating the display data is high, and the transparent display control unit **18** refers to the stored display state, and, when the transparent display is ON, temporarily switches OFF the transparent display (S**44**).

Afterwards, the process proceeds to step S**45**, and the display data obtaining unit **14***c* obtains display data of the changed selected window (S**45**).

The remaining process will be the same as the embodiment 1. In other words, the operation input accepting unit **12** determines whether display data sharing is ended by a user (S**50**). The operation input accepting unit **12** accepts a sharing end operation when "END SHARING" is selected from a list.

In the case where an operation of selecting "END SHARING" is not detected (NO in S**50**), the process proceeds to step S**78** in FIG. **23** and the display data is transmitted. Afterwards, the process returns to step S**40**.

In the case where an operation of selecting "END SHARING" is detected (YES in S**50**), the transparent display control unit **18** refers to the stored display state and the display state is returned to the stored display state (S**60**).

According to an information processing apparatus **20** according to the embodiment 3, it is further less often than the embodiment 2 to switch OFF the transparent display, and thus, compared with the embodiment 2, it is further less likely that the user feels something is wrong due to the change of display state. For example, when performance of the information processing apparatus **20** is relatively high, the information processing apparatus program **119** according to the embodiment 3 will be effective.

The information processing apparatus **20** may obtain a model number of the CPU and a memory capacity, and determine which process of the embodiments 1 through 3 should be employed. With the above operation, the necessity of switching OFF the transparent display can be minimized according to the performance of the information processing apparatus **20**.

Embodiment 4

In the embodiments 1 through 3, the flickering screen of the display device **120** is suppressed by switching the transparent display from ON to OFF in the case where the display data is shared.

However, because the flickering screen occurs due to heavy load of a display process, there is another method for suppressing the flickering screen other than the method of switching OFF the transparent display. The other method includes reducing the load of creating the display data from a window.

In the case where a mouse cursor is combined with the display data, in order to make the mouse cursor appear to be moving smoothly, the instruction information obtaining unit **141** obtains the coordinate of the mouse cursor and obtains the icon image **17***g* more often than a predetermined frequency (e.g., one or more times per second), and the display data creating unit **142** combines the icon image **17***g* with the display data more often than a predetermined frequency.

Further, a process of obtaining the coordinates of the mouse cursor, obtaining the icon image **17***g*, and combining them is performed separately from a process of obtaining the display data.

As a result, the load of a process of obtaining the display data and combining the mouse cursor with the display data (that is, the load of a series of an obtaining process and a combining process) is high.

Therefore, an information processing apparatus **20** will be described in which the flickering screen can be suppressed without switching OFF the transparent display in the case where the transparent display is ON, by reducing the frequency of obtaining the display data or by not combining the mouse cursor with the display data.

FIG. **30** is a flowchart of an example of a process which can replace a process of "switching OFF the transparent display if the stored transparent display of the display state is ON" in step S**30** of FIG. **24**. In other words, in the case where the stored transparent display of the display state is ON, the display data obtaining unit performs the process shown in FIG. **30**.

In FIG. **30**, the display data obtaining unit **14***c* determines whether the display data should be created by using a variable i. For example, the frequency at which the display data obtaining unit **14***c* obtains the display data is restricted in such a way that the display data obtaining unit **14***c* obtains the display data once in every n times the instruction information obtaining unit **141** obtains the instruction information. Here, n is, for example, a natural number of 2 or more. There are various methods to determine the value of n. For example, n may be determined by a specification of the information processing apparatus **20**, or n may be determined by setting by a user.

First, when the operation input accepting unit **12** accepts from the sharing button **533** an operation of selecting a window, the display data obtaining unit **14***c* initializes the variable i by setting 1 (S**30-1**).

Next, the display data obtaining unit **14***c* determines whether i=1 (S**30-2**), and obtains the display data only in the case where i=1 (S**30-3**). The display data obtaining unit **14***c* updates the display data stored in the RAM **103** or in the flash memory **104**. In the case where i≠1, the display data obtaining unit **14***c* does not obtain the display data, and thus, the load of obtaining the display data can be reduced.

Next, the instruction information obtaining unit **141** obtains the image data of the mouse cursor (S**30-4**). Next, the instruction information obtaining unit **141** obtains the coordinate data **17***h* of the mouse cursor (S**30-5**).

Next, the display data creating unit **142** combines the image data of the mouse cursor with the display data (S**30-6**). In other words, regardless whether the display data is updated, the image data of the mouse cursor is combined with the display data. As a result, the mouse cursor appears to be moving smoothly to the user.

When the display data obtaining unit **14***c* obtains the display data in which the mouse cursor is combined, the display data obtaining unit **14***c* increments the variable i by 1 (S**30-7**).

Next, the display data obtaining unit **14***c* determines whether i=n (S**30-8**). In the case where i=n (YES in S**30-8**), the display data obtaining unit **14***c* initializes the variable i by setting 1 (S**30-9**).

With the above operation, once in every n times the instruction information is obtained, the information process-

ing apparatus **20** can obtain the display data and combine the image data of the mouse cursor with the display data.

It should be noted that the display data obtaining unit **14***c* may cause the instruction information obtaining unit **141** to stop obtaining the instruction information. In the case where the instruction information obtaining unit **141** does not obtain the instruction information, the image data of the mouse cursor is not combined with the display data, and thus, the obtaining process load can be reduced compared with only reducing the frequency of obtaining the display data. Further, if it is enough for suppressing the flickering screen, only combining the image data of the mouse cursor with the display data may be stopped without reducing the frequency of obtaining the display data.

In the case where the frequency of obtaining the display data is reduced, or in the case where the image data of the mouse cursor is not combined with the display data, similar to the case in the embodiments 1 through 3, it is preferable that the fact of such an operation be displayed on the display device **120**. The user can understand the situation that the frequency of obtaining the display data is reduced and that it is not appropriate to transmit the display data of a moving image, and thus, the user can understand why the image data of the mouse cursor is not combined.

As described above, FIG. **30** is a drawing illustrating a process which can replace step S**30** in FIG. **24** according to the embodiment 1. Similarly, the process illustrated in FIG. **30** can also replace steps S**30** and S**44** in FIG. **27** and steps S**30** and S**44** in FIG. **28**.

Further, the embodiment 4 and the embodiments 1 through 3 may be switched according to the user selection. For example, the user may select between reducing the update frequency of the display data (and stopping combining the image data of the mouse cursor) and switching OFF the transparent display. The user can avoid the flickering screen by using the user's favorite method.

Further, in the embodiment 4, the update frequency of the display data is reduced. However, a number of colors may be reduced. The amount of captured display data of the selected window is affected by the number of colors in addition to the width and height of the selected window. The number of colors can be selected by, for example, selecting from 16 bits or 32 bits as a bit number of a pixel. The more the amount of the display data, the heavier the display process load.

Therefore, the flickering screen can be suppressed, without switching OFF the transparent display, by reducing the number of colors of the screens (of the desktop window and the application window). It should be noted that, similar to the case of the reduction of frequency of obtaining the display data, the user may select between the methods for suppressing the flickering screen.

As described above, the flickering screen can be suppressed in the case where the information processing apparatus **20**, which replaces a dedicated terminal, transmits the image data, audio data, and the display data. It should be noted that the flickering screen may be suppressed by switching OFF the transparent display in the case where the information processing apparatus **20** obtains the display data as the external input apparatus **40**.

As described above, a video conference system is used as an example of the transmission system **1** shown in FIG. **1**. However, the transmission system **1** is not limited to a video conference system, but may be a telephone system such as an Internet Protocol (IP) telephone, an Internet telephone, etc.

Further, the communication system of a mobile telephone or a smartphone may be replaced by the transmission system **1**. In this case, the information processing apparatus **20** or the transmission terminal **10** corresponds to a mobile telephone. The information processing apparatus **20** or the transmission terminal **10** as a mobile telephone includes a body of a mobile telephone, a display button, a display portion, a mike, and a speaker included in the body. It should be noted that the display portion is a touch panel.

In this case, the information processing apparatus **20** or the transmission terminal **10** is connected to the communication network **2** via a mobile telephone line (including wireless communication that mainly covers a relatively wide range such as outdoors by using aerial power from a base station), or the like.

Further, as shown in FIG. **31**, the information processing apparatus **20** or the transmission terminal **10** may be used as a car-navigation apparatus. FIG. **31** is a drawing illustrating an example of a system structure diagram in the case where the information processing apparatus **20** or the transmission terminal **10** is used as a car-navigation apparatus. In this case, one of the information processing apparatus **20** and the transmission terminal **10** corresponds to a car-navigation apparatus **20-2** installed in a car **601**. The other of the information processing apparatus and the transmission terminal **10** corresponds to a management terminal **20-1** used by a communicator of a management center **604**, a management server **603** for controlling the car-navigation apparatus, or a car-navigation apparatus **20-3** installed in another car **602**.

FIG. **32** is a structure diagram of an example of a car-navigation apparatus. The car-navigation apparatus includes a control unit **611** for controlling the entire apparatus, a GPS receiver **612**, a vehicle speed sensor **613**, a gyro sensor **614**, road map data **615**, etc. Further, an information processing apparatus **20** according to an embodiment is connected to the control unit **611**. The control unit **611** includes a microcomputer, etc., executes a program, and provides functions as a car-navigation apparatus. The GPS receiver **612** captures GPS satellite signals and outputs a coordinate set of its current position. The vehicle speed sensor **613** detects speed of a vehicle (rotational speed of a wheel). The gyro sensor **614** detects angular velocity. A direction of travel of a vehicle can be calculated by integrating the angular velocity.

The road map data **615** is data in which a node and a link are combined to represent a road, which may be downloaded from outside or stored in the vehicle beforehand. The road map is displayed on the display device **120**.

It should be noted that the car-navigation apparatus may also include an audio function for outputting music or TV broadcasting. Further, the car-navigation apparatus may include a browser function for displaying a Web site.

The control unit **611** estimates a position of the vehicle by applying an autonomous navigation method to positional information detected by the GPS receiver **612**, in which method a travel distance calculated by the car speed sensor **613** is combined with the direction of travel detected by the gyro sensor **614**. The position of the vehicle is displayed on the road map by using a vehicle mark or the like.

The car-navigation apparatus is connected to the communication network **2** via a mobile telephone line, etc., by using a function of the information processing apparatus **20** or a function of a mobile telephone.

The information processing apparatus **20** displays on the display device **120** a screen as shown in FIG. **15**, and a user selects a destination terminal from a list of destination terminals displayed on the display device **120**. After the login, image data of a camera and audio data can be

transmitted and received. Further, with an operation by the user, the information processing apparatus **20** can obtain display data including the road map data and TV video data. In this case, the car-navigation apparatus can transmit the display data to a destination car-navigation apparatus.

Therefore, similar to the information processing apparatus **20** or the transmission terminal **10** installed in an office, the information processing apparatus **20** installed in a mobile body can also transmit and receive image data, audio data, and display data.

As described above, referring to the drawings, an embodiment of the present invention is described in detail. It should be noted that the above description is provided to help in understanding the present invention, and is not intended to limit the scope of the invention. Further, the embodiments are not exclusive to each other. Therefore, elements of different embodiments may be combined as long as no conflict arises. Various modifications and variations may be possible within the scope of the claimed invention.

DESCRIPTION OF THE REFERENCE NUMERALS

1 transmission system
2 communication network
10 (**10***ba*, **10***bb*, **10***da*, **10***db*) transmission terminal
14*a* imaging unit
14*b* image display control unit
14*c* display data obtaining unit
18 transparent display control unit
(**20***aa*, **20***ab*, **20***ca*, **20***cb*) information processing apparatus
(**30***a*, . . . , **30***d*) relay apparatus
40 (**40***aa*, . . . , **40***db*) external input apparatus
50 transmission management system
120, **216** display device
141 instruction information obtaining unit
142 display data creating unit

What is claimed is:

1. An information processing apparatus capable of communicating with another apparatus via a network, the information processing apparatus comprising:

circuitry configured to

display an image on a display apparatus included in or connected to the information processing apparatus;

transmit image data of the image displayed on a screen of the display apparatus to the another apparatus via the network; and

reduce a processing load involved in displaying the image on the display apparatus when the circuitry transmits the image data to the another apparatus, wherein

the circuitry displays the image on the display apparatus in a transparent display state in which the image is displayed transparently in a display area located in the screen of the display apparatus such that an overlapped portion of a first window of the image over which a second window of the image overlaps is visible, or in a non-transparent display state in which the image is displayed non-transparently in the display area such that the overlapped portion of the first window over which the second window overlaps is not visible, and

the circuitry switches the display state of the image displayed in the display area from the transparent display state to the non-transparent display state when the circuitry transmits the image data to the another apparatus.

2. The information processing apparatus according to claim **1**, wherein

a second load involved in the non-transparent display state being less than a first load involved in the transparent display state.

3. The information processing apparatus according to claim **1**, wherein the circuitry is further configured to set whether first image data of a first image displayed on an entire screen of the display apparatus is obtained, or second image data of a second image of the display area is obtained,

the circuitry does not reduce the processing load involved in displaying the image on the display apparatus when the circuitry sets that the first image data of the first image displayed on an entire screen of the display apparatus is obtained, and

the circuitry reduces the processing load involved in displaying the image on the display apparatus in the case where the circuitry sets that the second image data of the second image of the display area is obtained.

4. The information processing apparatus according to claim **1**, wherein

the circuitry reduces the processing load involved in displaying the image on the display apparatus when a part of display contents exists out of a screen area of the display apparatus.

5. The information processing apparatus according to claim **1**, wherein

the circuitry displays on the display apparatus information indicating that the processing load is reduced when the circuitry reduces the processing load involved in displaying the image on the display apparatus.

6. The information processing apparatus according to claim **1**, wherein the circuitry is further configured to obtain the image data of the image displayed on the display apparatus, and

the circuitry reduces the processing load involved in obtaining the image data of the image displayed on the display apparatus when the circuitry transmits the image data to the another apparatus.

7. The information processing apparatus according to claim **6**, wherein

the circuitry combines an image of a pointing device with the image data, and

the circuitry obtains the image data less frequently when the circuitry transmits the image data to the another apparatus than when the circuitry does not transmit the image data.

8. The information processing apparatus according to claim **6**, wherein

the circuitry combines an image of a pointing device with the obtained image data when the circuitry does not transmit the image data to the another apparatus, and

the circuitry does not combine the image of the pointing device with the obtained image data when the circuitry transmits the image data to the another apparatus.

9. An information processing system comprising:

a plurality of information processing apparatuses capable of communicating with each other, wherein

a first information processing apparatus of the plurality of information processing apparatuses includes circuitry configured to

display an image on a first display apparatus included in or connected to the first information processing apparatus,

transmit image data of the image displayed on a screen of the first display apparatus to a second information processing apparatus, and

reduce a processing load involved in displaying the image on the first display apparatus when the circuitry transmits the image data to the second information processing apparatus, and wherein

the second information processing apparatus includes circuitry configured to

receive the image data, and

display the image data on a second display apparatus, and

the first information processing apparatus displays the image on the first display apparatus in one of a transparent display state and a non-transparent display state, the transparent display state being a state in which an image in a display area within a screen of the first display apparatus is displayed transparently such that an overlapped portion of a first window of the image over which a second window of the image overlaps is visible, and the non-transparent display state being a state in which the image in the display area is displayed non-transparently such that the overlapped portion of the first window over which the second window overlaps is not visible, and

the first information processing apparatus switches the display state of the image displayed in the display area from the transparent display state to the non-transparent display state when the first information processing apparatus transmits the image data to the second information processing apparatus.

10. The information processing system according to claim **9**, wherein

the first information processing apparatus displays the image on the first display apparatus in one of a plurality of display states having different processing loads, and

the first information processing apparatus switches the display state of the image displayed on the first display apparatus from a first display state to a second display state when the first information processing apparatus transmits the image data to the second information processing apparatus, a second load involved in the second display state being less than a first load involved in the first display state.

11. A method for an information processing apparatus capable of communicating with another apparatus via a network, the method comprising:

displaying an image on a display apparatus included in or connected to the information processing apparatus,

transmitting image data of the image displayed on a screen of the display apparatus to the another apparatus via the network; and

reducing a processing load involved in displaying the image on the display apparatus when the the image data is transmitted to the another apparatus, wherein

the displaying displays the image on the display apparatus in one of a transparent display state and a non-transparent display state, the transparent display state being a state in which an image in a display area within a screen of the display apparatus is displayed transparently such that an overlapped portion of a first window of the image over which a second window of the image overlaps is visible, and the non-transparent display state being a state in which the image in the display area is displayed non-transparently such that the overlapped portion of the first window over which the second window overlaps is not visible, and

the reducing switches the display state of the image displayed in the display area from the transparent display state to the non-transparent display state when the transmitting transmits the image data to the another apparatus.

12. The method according to claim **11**, wherein a second load involved in the non-transparent display state being less than a first load involved in the transparent display state.

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